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TRANSVERSE MAGNETIZATION AND CONDUCTIVITY.

It has long been known that bismuth has its conductivity diminished, or its resistivity increased under the influence of a transverse magnetic field. The increase in resistivity is given at about 11 per cent in a transverse field of 8 kilogausses. A similar, but much smaller, effect has also long been recognized in the magnetic metals, iron, cobalt and nickel. The property has been utilized for the measurement of magnetic flux-densities in air-gaps, and bismuth spirals connected to resistance-measuring apparatus have been frequently used for the purpose of exploring magnetic fields. It has not generally been known, however, that a distinct but very feeble influence of the kind exists in metals generally, as for example, in copper. A recent number of the *Physikalische Zeitschrift* publishes an interesting paper by Herr Leo Grunmach on a research in this direction. Although the resistivity effect of transverse magnetization is extremely small in ordinary metals, a knowledge of its magnitude has a distinct bearing on the electronic theory of electric conduction in metals. According to this theory, there are vast hordes of free corpuscles, or subatomic free particles of matter, present, at any instant, in the substance of a metal. These free electrons are all similar and similarly charged electrically. They are perpetually dancing about with amazing swiftness of oscillation, in very minute paths, in all directions equally.

Under the influence of an impressed e.m.f. at the terminals of a metallic wire, however, the electronic movements take a distinct set, or tendency, towards the poles, within the range of their oscillation. They tend to set up a sort of bucket-brigade for the transfer of electricity along the wire. The conductivity of a given size of the wire depends upon the number of free electrons, as well as on their mean frequency and distance of oscillation. These conditions vary from metal to metal. It is supposed that a transverse magnetic field brought to bear upon the wire bends the electronic paths sideways, just as a magnetic field bends an arc sideways. This deflection of the direction of movement in the bucket-brigade reduces the effective transfer of electricity, or diminishes the conductivity of the wire. The amount of the disturbance will depend upon the intensity of the magnetic field, and upon the average velocity of the oscillatory electrons in the metal. From the observed increase in resistivity, taken in connection with other experimental data, inferences can be reached as to the number and activities of the free electrons in metal. The paper shows that in a field of ten kilogausses the resistivity of cadmium increases 0.03 per cent, zinc 0.002 per cent, silver, copper and gold 0.003 per cent, lead, platinum and tantalum less than 0.001 per cent. In iron the resistivity increases up to about 4 kilogausses; then the effect diminishes, until near 8 kilogausses when the original resistivity is restored. Thereafter, the resistivity diminishes, or changes sign, with further increase of field.

THE MOST EFFECTIVE DESIGN OF D'ARSONVAL GALVANOMETERS.

As was pointed out on page 589 of our issue for September 29, for the measurement of extremely small currents the suspended-

needle type of galvanometer is found well adapted. This instrument, however, is subject to the great disadvantage of being influenced by stray magnetic fields, which cannot conveniently be prevented. The difficulty due to the use of the extremely weak field required when the needle galvanometer possesses a high degree of sensitiveness—its sensitiveness varying inversely with the field strength—has been surmounted by the adoption of the D'Arsonval type of instrument in which the sensitiveness depends directly upon the field strength, and a magnetic field so strong as not to be influenced by any ordinary stray field is employed in all cases. Although in regard to its freedom from disturbances due to external causes, the D'Arsonval galvanometer is far preferable to the suspended-needle type of instrument, the fact remains that with reference to its sensitiveness the latter galvanometer is much better than the former. The most difficult problem connected with the design of the D'Arsonval type of galvanometer resides in the fact that extreme measures must be employed if great sensitiveness is desired.

On page 959 of our issue for November 17, Professor L. A. Freudenberger outlined in an instructive manner the various factors entering into the problem, and showed how the maximum sensitiveness may be obtained. Knowing that for a given volume of suspended material the maximum ratio of torque per unit current to moment of inertia of the suspended mass is obtained when the coil is in the form of two cylinders with the least possible lateral dimension, it is shown that the maximum sensitiveness results when the ratio of length to breadth of the bobbin is as great as possible. It would seem that such result was to be anticipated at once from the fact that the material involved in the construction of the two semi-circular ends of a suspended coil having a certain lateral dimension is entirely independent of the length of the coil, while the ratio of this material to the total material employed depends entirely upon the length chosen. Since the torque produced by a given current per unit length of wire is considerably larger along the sides than over the ends of the coil, it follows that the ratio of the torque to the material employed is larger the longer the coil. It is instructive, however, to find that these superficial considerations are amply corroborated by a detailed study of the various torque actions and moments of inertia. Consideration of the fact that a certain torque on the suspended bobbin can be obtained with the smallest current by the use of the largest number of conductors, modified by the fact that as the size of the wire is decreased the relative space occupied by the insulation is increased, leads to the conclusion that the maximum sensibility would be obtained with a wire about .5 mil. in diameter. The practical significance of this conclusion is that the most sensitive instrument is the one using the smallest obtainable wire; that is, a wire about 1.5 mil. in diameter.

Oscillographs and Their Applications.

Ever since alternating-electric currents came into industrial prominence, the shape of alternating-current waves has assumed considerable importance, because many phenomena presented in alternating-current circuits intimately depend upon the wave shape. Various attempts were made to detect and record the shapes of alternating-current waves; but to M. André Blondel belongs the credit of the design of the oscillograph, an instrument capable of recording the contour of a wave photographically. The modern types of construction have been developed by various individuals and firms, in England, France, Germany and the United States. The article by Mr. David A. Ramsay appearing on page 999 of this week's issue, describes the more recent developments in one of these types. The oscillograph has acted ever since its introduction as an agent for the sine wave. Prior to the use of the oscillograph, sine waves were studied and expanded in text-books on alternating-currents, because the sine wave is the simplest type of wave, and one which is very prevalent in nature. Nevertheless, the introduction of the iron-clad alternator armature, or the tooth-cored instead of the smooth-cored armature, tended to produce a voltage wave that was far from sinusoidal; so that the advantages of a sine wave were restricted to literature and description. Moreover, it became known that peaked waves of voltage reduced the hysteresis losses in transformers; so that there is a slight but distinct increase in the efficiency of a transformer distribution system when a sinusoidal-voltage alternator supplying the system is replaced by a peaked-voltage alternator. For a time designers of alternators were led to aim at the production of voltage-waves deviating from the sinusoidal in a definitely peaked manner.

In recent years the development of long-distance and high-voltage distribution has shown that the sine wave has marked practical advantages over all other types at the present time, and the oscillograph has not only aided in demonstrating this fact, but it has also assisted the designer in working towards a sine wave of voltage, by giving him a permanent photographic record of the voltage wave produced at no load, or at any desired load of an alternator. The article describes, in particular, a type of oscillograph suitable for use on 30-kilovolt alternating-current circuits. Very high insulation is, of course, necessary in the construction of an instrument designed to be connected directly with such a voltage. A high-resistance woven-wire fabric immersed in oil, and offering a definite resistance per square meter, is also employed. It is, no doubt, an achievement to produce an oscillograph that may be connected to a 30-kilovolt circuit; but we should be inclined to doubt the necessity of using such an instrument directly connected to the high-pressure feeders. No doubt such an instrument would have applications in special fields such as wireless telegraphy, high-frequency oscillators and the like; but in connection with ordinary alternators, it would seem that a low-tension oscillograph might safely be used with step-down transformers. It is pointed out in the article that iron-cored transformers may fail to reproduce important higher harmonics in the voltage waves of high-tension circuits.

In dealing with transmission problems one should consider, however, that alternators, being loaded with heavy iron magnetic circuits, are not likely to generate voltage-ripples of a frequency higher than iron-cored transformers can repeat. Besides, even granting that iron-cored step-down transformers would fail to repeat the high-frequency ripples; or to catch high-frequency oscillations of a circuit at switching a generator on or off, it would still seem simpler and safer to build an iron-cored step-down transformer immersed in oil, with a grounded low-tension oscillograph, instead of connecting directly to a high-tension circuit. This is, however, a question of detail, aside from the use of the oscillograph in general. None of the oscillograms presented are novel, although they are interesting and clear. The advantages of oil-switches in breaking a circuit, at or near the current-zero, over air-switches, which are apt to break at any current-phase, are now well-known. The vowel oscillogram look more formidable than they sound, and indicate how complex must be the vocal waves in speech. The simple sine wave seems to be the least likely of all vocal waves to be produced.

THE REFLECTION AND TRANSMISSION OF ELECTRIC WAVES BY GRIDS.

The October number of the *Physical Review* contains a paper by Messrs. F. C. Blake and C. R. Fountain on certain laboratory experiments with short electro-magnetic waves; that is, waves approximately only a decimeter in length, produced by a particular form of Righi oscillator. Among other observations it was endeavored to ascertain the proportions of reflected and transmitted energy when the beam of waves was intercepted by a grid of fine parallel copper wires mounted on a rectangular wooden frame roughly a meter square. The observations show that this grid was impervious to the waves, or was practically as good as a solid sheet of copper, when the fine parallel copper wires were separated interaxially by one-fortieth of a wave-length. Very little energy went through the grid when the spacing was one-twentieth of a wave-length, but as the spacing between the grid-wires increased beyond this value, the transparency of the grid rapidly increased, until at a spacing of four-fifths of a wave-length the transparency was almost complete. If these short-wave measurements apply equally to wireless telegraph waves, say 300 meters long, then a grid of tall vertical wires 7½ meters apart should be an opaque barrier to incoming electric waves, and a vertical metal frame with elements closer than this, should also be expected to form a wave-tight cage for keeping out long waves.

SPARKING APPARATUS FOR GAS ENGINES.

We are glad to be able to present the first section of a most valuable paper on this topic by Prof. F. W. Springer. It has been a neglected field which has long deserved attention. The present part of the research is devoted to what is here called the "touch spark," known in automobile parlance as make-and-break, as contradistinguished from the "jump" spark. The general characteristics of the method are well known, it being akin to the ordinary method used for domestic gas lighting. It has the great advantage of giving a spark which is mechanically timed with considerable precision, at the cost, however, of a mechanical and electrical connection through the cylinder wall with all the difficulties aggravated by high temperature. Prof. Springer refers to its frequent employment in moderate speed engines, but it is to be noticed that it is steadily coming into use in fast and powerful automobile engines. We should be inclined to the opinion that in spite of the mechanical difficulties it is of peculiar usefulness in very fast-running engines. Prof. Springer finds that the work demanded of the battery is decreased at high speeds, other things being equal, since the contact time in charging, so to speak, the electrodes is lessened. Every increment of the close circuit interval is a drag on the battery and all time beyond that required for the current-time curve to become asymptotic is a useless expenditure of energy. The weakening effect on the battery is thereby greatly increased as the engine speed decreases, and the contact time prior to the spark is made the longer. Looking at the curves of the paper one notes that the energy in the spark may be greatly modified by variations in the design of the apparatus and that the comparatively high voltages given by a dynamo furnish much more favorable conditions for powerful ignition than the lower battery voltages.

In any case the spark produced seems to be ample for practical ignition and it is noticeable that in Prof. Springer's tests of the working of sparks of varying length the engine seemed to operate with complete uniformity whether the spark length were 1/32 or 10/32 in. Evidently at the compressions common in gas engine practice ignition is a comparatively easy task, and it should be possible by careful design to get reliable sparking with a much smaller expenditure of energy than is now usual. It seems to be the certainty of a spark rather than its magnitude that is the crucial point in operation. Yet we should like to see and we hope that Prof. Springer will furnish later data on the minimum length or energy of spark that will furnish reliable ignition. There must be some observable difference, although a spark able to do the work normally may be too small for practical use on account of dirty and uncertain connections, requiring a large factor of safety. If, as the present paper shows, a very modest spark length is entirely effective, then the whole outfit could well be designed with this in view and much greater life of the batteries would thereby become attainable. At the present time rule-of-thumb generally guides the design and the results are far from what they should be. Another important thing to be considered is the possible effect of oil and dirt in the working parts upon the resistance of the circuit. To judge from the curves of the paper even a considerable increase of resistance would still leave a good margin of safety, and in fact it seems to be generally thought that a touch spark system is very satisfactorily reliable, assuming that the mechanical parts give no material trouble. A good mechanical break will give a working spark under very trying circumstances, timed with high precision. One must remember that the piston speeds in fast-running automobile engines go to high figures, so that a change of a few thousandths of a second may make all the difference between maximum efficiency and back firing. The duration of the discharge makes less of difference since it does its work at the beginning and cannot be enough prolonged to cause trouble in the subsequent part of the cycle.

Prof. Springer's suggestions for the design of coils for touch spark work should be taken to heart. They are founded on well-known and sound principles, but are especially pertinent in their discrimination between the high resistance coils permissible if dynamo ignition is to be tried, and the battery coils which are more commonly required. A difference in absolute time constant of the coils is here less important than proportioning for the efficient use of the battery—a particular battery, not anything that comes handy. For given coil and battery the timing of the spark can be accurately adjusted, but the full bearing of timing on the performance of the engine has yet to be investigated. We hope that later Prof. Springer will take opportunity to go further into the question of engine performance and show the relation of sparking to ignition under various compressions and with various mixtures. There is a huge field almost or quite unexplored in relation to the gasoline engine. Little enough is known about the gas engine working with a constant fuel, but with a gasoline engine drawing its supply not from a large storage tank, but from a mixer, and working at all sorts of speeds, the conditions of efficient use of fuel need investigation sadly. Igniting apparatus needs to be studied in relation to all this in order to determine the necessary factor of safety, so to speak, in supplying the energy. By and large, it is wonderful considering the empirical condition of the whole matter, that engines work as well as they do. Researches, such as the one under consideration, can put ignition on a rational scientific basis so far as the electrical conditions are concerned. The mechanical part of the problem is still a serious one, for even if one knows that battery and coil are all that they should be, the flying contacts required to do the timing still give ample chance for trouble. Prof. Springer has done capital work in clearing up the initial difficulties and we hope he will continue further along the same important line.

Wireless Telegraph Consolidation.

A rumor is afloat that certain interests are planning a consolidation of wireless telegraph companies which will bring under one head the Marconi and De Forest systems of America and Europe. Abraham White, president of the De Forest Company, last week announced that a company, to be called the United Wireless Telegraph Company, will be formed, which will take over the Marconi Wireless Telegraph Company, Limited, of England, which controls the Marconi Companies of America, Canada and Europe, and the American De Forest Wireless Telegraph Company, which is the parent company of the English De Forest enterprise. These two concerns control the bulk of the wireless systems now operating in English-speaking countries, with instruments on substantially all of the ocean-going vessels flying the American and English flags. The United Wireless Telegraph Company is to be capitalized at $20,000,000. The directors of the new company are: Abraham White, president of the American De Forest Company; H. H. Buchanan, of A. O. Brown & Co., bankers; H. H. McClure, director Marconi Wireless Company; Don Giovani del Principi del Drago, of Rome; George Irving Whitney, Pittsburg, Pa.; C. C. Galbraith, general manager Atlantic Wireless Company; S. S. Bogart, former general superintendent Western Union Telegraph Company; Charles A. Lieb, mechanical engineer, formerly expert for General Electric Company; Greenleaf Whittier Pickard, former engineer American Bell Telephone Company; John S. Seymour, Francis K. Butler, Phillip Farnsworth, Arthur English and George C. Knabe, all of this city. Mr. White is president of the new company, Mr. Buchanan vice-president, Mr. Knabe treasurer, and Mr. English secretary.

All these statements are denied categorically by ex-Gov. John W. Griggs, of New Jersey, who is president of the Marconi Wireless Telegraph Company of America. He says:

"The managers of the Marconi's Wireless Telegraph Company, Limited, and of the Marconi Wireless Telegraph Company of America, deem it their duty to the public to deny absolutely and unequivocally that the United Wireless Telegraph Company has acquired control of more than 51 per cent of the Marconi's Wireless Telegraph Company, Limited, and to deny that the United Wireless Telegraph Company controls a majority of the stock of the Marconi Wireless Telegraph Company of America. The managers, directors and a majority of the stockholders of both of the Marconi Companies are not interested in any wise in the United Wireless Telegraph Company; the latter company has no agreement or prospect of agreement by which it will obtain control of either of said Marconi Companies, and the scheme of merger announced by Mr. White is antagonistic and repugnant to the interests of both of the Marconi Companies."

In addition to the denials of the Marconi officials of any part in the merger, the plans of Mr. White are further interfered with, according to a notification received at the Marconi offices from James A. Allen, attorney for certain De Forest stockholders, by an injunction granted in the United States Circuit Court in Maine, restraining Abraham White, the American De Forest Wireless Telegraph Company, and other White concerns from transferring the patents and plants of the De Forest Company.

Two of the directors elected to office in Mr. White's new company announced recently that they would not serve. They are G. I. Whitney, of Pittsburg, and E. F. Buchanan, of the firm of A. O. Brown & Co. Both men pleaded that they were too busy to serve.

Annual Meeting of the Electrical Trades Association of Chicago.

The eleventh annual meeting of the Electrical Trades Association of Chicago was convened at the Grand Pacific Hotel, Friday evening, November 16. More than eighty manufacturers and jobbers from the Central, Southern and Western States were in attendance. A dinner preceded the business meeting, which was called to order by the president, Frank S. Beardslee. The reports of the officers of the association showed a remarkable increase, both in membership and in a widening field of efficient service.

The Board of Directors was increased by an amendment of the by-laws from five to seven members, and the election resulted as follows: President, Seymour Guthrie, of the Kellogg Switchboard & Supply Company; William Browne, M. B. Austin Company, vice-president. Members of the Executive Board—Thomas I. Stacey, of the Electric Appliance Company; Harry R. Parsons, Western Electric Company; Frank Beardslee, of the Beardslee Chandelier Manufacturing Company; Frank M. Pierce, Manhattan Electrical Supply Company; S. E. Kennedy, Central Electric Company. Mr. Frederic P. Vose was reappointed secretary and treasurer. After the conclusion of the business session, Mr. Thomas G. Grier, of the American Circular Loom Company, acted as toastmaster, and toasts were responded to by Messrs. James Wolff, L. N. Bardold, Harry R. Parsons and by about twenty others.

Electric Railways in Vermont.

The report has just been issued of the Board of Railroad Commissioners of the State of Vermont. It is an interesting document and enters into many details with regard to the trolley systems. Two passages may be quoted. One deals with the question of capitalization as follows: "Two years ago this commission called attention to the fact that methods have been employed in financing electric railways in Vermont that have proved very disastrous to investors. No restraint whatever is imposed upon capitalization or the creation of funded indebtedness, except the limitations of the charter and the consciences of the promoters and those limitations are usually so widely in excess of the actual funds necessary to build and equip the road that a large margin is left in the shape of stocks and bonds in which the public is invited and solicited to invest. The operation of the road discloses the fact that the gross earnings will not pay operating expenses and the interest on the bonds, to say nothing of any dividends on the stock. The result is a defaulting of the interest, loss of credit, shrinkage of stock and bond values, deterioration of road and equipment, receivership and foreclosure. And these inevitable results are being encouraged by the State at the behest of a few adventurers who aim to reap large profits by the sale of securities which do not represent real value. Such a policy does infinite harm to the State as a whole. It discredits Vermont securities that are sound; it advertises the fact that Vermont is an open field for the promotion of hazardous enterprises and the flotation of illegitimate schemes calculated to separate a man from his money. The unexpected risks involved in an investment in electric railway securities in Vermont and the losses sustained by the investing public outside of Vermont affects the reputation and character of every kind of security offered the public which emanates from Vermont.

"Our State should be in line with Massachusetts on this subject and require every issue of railroad stocks or bonds to be approved by some competent authority in order that there may be some guarantee that they measurably represent actual value in the construction and equipment of the road. Two years ago this commission procured the introduction of a measure similar to the Massachusetts law upon this subject and the influence of interested persons was successfully exerted to prevent the passage of the bill. The inquiry is pertinent, what right has Vermont to expect capital from other States to seek investment here in the development of our resources if the State encourages the laying of traps by promoters to fleece the uninformed stranger out of his money? To suggest or recommend what ought to be enacted in the way of legislation has heretofore been productive of no results. The above comment has been forced by the defiant attitude of those who oppose wholesome regulation of electric railways and by their influence among legislators defeat the passage of measures which would afford relief from conditions that ought to be regarded in any State as intolerable."

Comment is made upon the absence of crossings other than at grade and the lack of protective electric signals, and specific reference is made to conditions at Rutland, where, it is asserted, the protection of the public remains neglected in spite of the

orders of the commission. The report deals with this situation and kindred matters as follows: "It has been claimed that the railroad commission is a useless and expensive adjunct of the State government. But the railroad commission is just what the general assembly has made it. If the legislative authority yields supinely to the unfortunate influence of railroad representatives outside the green baize doors of the legislative halls and permits this influence to dictate how impotent a railroad commission shall be, then the fault is with those who constitute the law making body. The inevitable consequence is that the people must suffer the outrageous inconveniences of railroad travel, lack of proper connections between trains of different systems, inadequate facilities at railroad stations, delays in the adjustment of differences, dangers at highway grade crossings, insecure and improper management of electric railways, lack of farm crossings and many other failures to reasonably promote the safety, security and convenience of the public. A sure result of this indifference of the law making power to remedy these defects in the railroad law of the State is the discordant note of defiance which goes up from at least one railroad corporation whenever the railroad commission seeks to afford relief to petitioners upon abundant proof that wrongs are being suffered. Secure in the conclusion that the general assembly will not clothe the railroad commission with any real authority this railroad company insolently refuses to obey any mandate of the commission."

Hydro-Electric Developments at Salisbury, N. C.

With the completion of the power plant of the Whitney Development Company, on the Yadkin River, near Salisbury, N. C., some time during the coming year, the industrial possibilities of Piedmont, N. C., will be enhanced by 40,000 hp.

The power house, which is now nearing completion, contains six 900-hp turbines. These turbines are of the vertical type and the dynamos are mounted directly on the turbine shafts. The initial voltage will be 11,000. The transformers will raise the e.m.f. of such electricity as may be transmitted not over 40 miles to 30,000 volts, and should it be found necessary to deliver energy to establishments more distant, the voltage will be stepped up to 60,000. The house which contains the turbines, generators and governors is about 600 feet long, 120 feet wide and 100 feet high. The dam, which is now nearing completion, is one of the best and most carefully constructed pieces of masonry in the Carolinas. It is built of dimension granite, laid to half-inch joints. The stone is taken from the company's own quarries 20 miles from the power house site and is dressed and dimensioned before being shipped. The dam is 1,000 ft. long between abutments and its top is 38 ft. above the river bed. It is 58 ft. wide at the base and 12 ft. at the crest, and is of the O-G type on the down-stream face, the alignment of the up-stream face being vertical. As it is arranged to operate the machinery fully, when the stream yields a minimum volume of water, a spillway is provided to take care of the surplus water when the river rises above its minimum level. The spillway follows the dam in construction, material and type and is 1,500 ft. in length, 38 ft. high and 40 ft. wide at he base. A canal, extending 4½ miles in length and having an average width at the surface of the water of 112 ft. and 40 ft. at the bottom, conveys the water from the dam to the turbines at the power house. The water in this canal is 18 ft. deep and the capacity is 3,300 cu. ft. per second. The canal furnishes an available head or fall at the turbines of 130 ft. There are 180,000 cubic yards of masonry in the dam and the spillway.

Every modern device to save labor and expedite the work is being brought into use. Four steam shovels, six steam locomotives and twenty-one steam derricks are being employed, and large concrete mixers, temporary trestles and many miles of construction track are in operation. A small modern auxiliary power house, built of dressed granite, is already finished. It has a capacity of 320 hp and is used for lighting the streets, offices and works. Over 2,000 men are at present employed in two shifts, working day and night. A modern brick plant is rapidly turning out the 25,000,000 bricks, which will be used to build factories and operatives' houses on the sites reserved by the company for industrial establishments.

From the line of the Southern Railway the owners have built into Whitney six miles of railroad, which is now being operated under lease by the Southern. This line is now being extended through a four-mile length of manufacturing sites, which will enable such factories as locate at Whitney to have the best railroad facilities from the very beginning. The line bisects a plateau between the canal and the river, which at once impresses a cotton manufacturer as being an ideal situation for almost any number of mills, and it is here that the promoters of the enterprise expect to see an industrial city erected within the next few years.

Handsome houses and offices have already been built for the engineering force, each being equipped with water, electric light and sewerage arrangements. The company's real estate holdings and riparian rights extend for fourteen miles, up and down the river, covering a belt from one to three miles wide along its entire length.

The center of the power district will naturally benefit more largely than places even in the near distance, for power must inevitably be always cheapest at its source. With the other falls on the company's property, which will be developed as soon as the present plant is finished, the company can sell to textile and other industries power enough to turn the equivalent of 4,000,000 spindles, approximately half the number now operated in the entire South.

An Engineer-Constructor Defined.

At the meeting of the Electrical Section of the Western Society of Engineers, held in the rooms of the society in the Monadnock Block, Friday evening, November 16, Mr. George A. Damon, managing engineer of the Arnold Company, presented a paper entitled, "What Is an Engineer-Constructor?" The paper was the result of a conference among engineers of the Arnold Company, and talks covering essentially the same material have recently been given by the engineers to engineering students of Purdue University and other Western colleges.

An engineer-constructor was defined as an organization for combining in the most advantageous manner technical knowledge, construction experience and executive ability for carrying out from conception to completion the big engineering problems that the development of the country brings up. As a means of interesting college students, such an organization was compared to the organization of a football team and the similarity of the two was shown to exist in many ways.

In deciding on the men for either organization the qualifications of each man must be studied, and moreover each man must be selected for his particular ability. Several advantages of having the engineering and the actual construction work of a large undertaking controlled by the same organization were pointed out. The unsatisfactory and inefficient method of handling large work by means of numerous overlapping contracts was eliminated. The fact that the engineer-constructor was always in the market gave its purchasing department advantage over the occasional buyer.

Some time was spent in showing how the central office directs construction work at distant points. Photographs showing progress and graphic reports were a means of keeping in touch with such work. The basis on which construction companies are usually paid was explained. The "cost plus a percentage" plan was the better where the "engineer-constructor" was capable, efficient and honest, and had complete control of a competent construction organization. If the work was planned by an engineer and architect, and the actual building work was turned over to a separate construction organization, then the "cost plus a fixed sum" plan no doubt had the advantage.

Aside from defining and outlining the work of the combined engineering and construction company, the paper made effort to point out to the young engineer the benefits of a scientific technical organization and the necessity of a thorough preparation along the lines of his natural aptitudes.

Improving Patent Office Conditions.

Advices from Washington state that there has been in preparation an address to the industrial and manufacturing interests of the country most seriously affected by patent office delays. This will be ready for circulation in a few days and will go out with the sanction and endorsement of the Patent Law Association of Washington, the representative body of attorneys engaged in business before the patent office. It has already been printed, under date of November 1, and in its first paragraph specifically contradicts those persons who have blamed Commissioner Allen for delays and official shortcomings. This paragraph reads:

"Knowing the unsatisfactory delay in securing patents and believing that the fault does not rest upon the officials and examining corps of the United States Patent Office, nor with the Congress of the United States, which, it is believed, is willing to promote every needed facility for prosecuting the work of the Patent Office, this association presents this statement of present conditions and proposed remedies to the inventors and manufacturers of the country in order that they may see the duty devolving upon them to fully advise their Senators and Representatives of the urgent and immediate relief demanded by present conditions."

The three pressing needs are specified as increase of room, increase of working force, and increase of salaries to prevent efficient examiners from being drawn away into private employment. The last is probably the most pressing need of the three, as without relief in this respect the granting of the other two will insure only temporary relief.

A correspondent of the New York *Evening Post* states that the examining corps of the office numbers 300 at its maximum, but by reason of assignments to other necessary work requiring equivalent ability has been reduced to 248. This force examined 51,885 cases in the past year, or an average of 209 cases for each examiner. This makes a record of practically one case taken up and completed for every working day of the year, as Government employes are entitled to a total of 60 days' annual leave on the score of vacation and sick leave.

"There are in the Patent Office 39 divisions, averaging six assistant examiners to each, with a principal examiner in charge. The increase in patent applications has reached 70 per cent, since the force was small as it is actually now, with the necessary special details subtracted from the number Congress officially supposes are at work. For the year ended last June 30 there were 21,958 applications awaiting action. On July 1 29 new examiners became available and started to learn their duties. The congestion of cases increased until it had reached 23,849 by the week ended September 4. Then the new men began to be effective, and every week since then has recorded a decrase in the mass of back work awaiting action. For the week ended November 13 last the number had been brought down to 16,836, and the present week is expected to show the total reduced to probably less than 16,000. While last week's reduction was exceptionally large, over 1,200, it was due in part to a slight falling off in that week's applications, so that the average improvement is 700 cases.

"Inventors are beginning to realize that, under these present congested conditions, their applications are buried in official files for seven months of valuable time before there is the slightest chance of their receiving official attention. As Secretary Hitchcock said to-day, it is impossible to show any favoritism, and order the taking up of a special case immediately, no matter how important it is as an invention, or to the welfare of the inventor. Every application is given its number, and then gathers dust until the inadequate force which is available can catch up with the back work, and reach that application. The reduction of the number of back cases shows that the force is competent enough to handle the work when it gets to it, but that it cannot get over the "hump" which lies between it and prompt attention to new applications."

"More than 20,000 inventors are forced to wait, in some instances for seven months," the circular referred to says, "before their applications receive an examination on their merits as to patentability. The examining corps is not censurable for this condition, for the official report shows that while the work since 1899 has increased over 70 per cent, the force, including clerks who do not examine applications, has increased only 12 per cent."

Last year's total applications were 72,236, to which should be added 1,607 "interference proceedings," making a total of 73,843 cases requiring examination. To meet this increase and bring the work up to date, it is estimated by patent attorneys here that there should be twenty additional divisions, each with seven examiners, and sufficient extra clerks to handle the work.

Electric Pumping in the City of Mexico.

The largest electric motors ever built for use in the Republic of Mexico are now being constructed at the works of the Westinghouse Electric & Manufacturing Company, at Pittsburg, Pa., for use in connection with Morris centrifugal pumps to pump water from Xochimilco to Mexico City. This will give Mexico one of the most modern water systems in use in any city to-day. The contract for these pumping stations is being handled through the Mexican Light & Power Company, which will supply the electrical power from its Necaxa power plant. The five stations will be provided with electric motors direct-coupled to their respective pumps and have a total normal capacity of 3,060 hp, capable of a maximum of 5,222 hp providing for overload capacity.

Only the most modern and substantial apparatus will be provided throughout the entire installation and every precaution has been taken to prevent any possibility of interference in service due to any cause whatever, a spare electrical unit with its pump being provided in each pumping station. The water will be pumped to reservoirs near to and above the city level.

In the first pumping station, "Condesa," will be placed three large Westinghouse synchronous motors of 1,200 hp each, making 720 r.p.m., pumping 850 liters of water per second. Two motor-generator sets will supply the direct current for exciting the fields of the three motors and all necessary switchboard and lightning arrester equipment is also being furnished. To reduce the voltage from the Mexican Light & Power circuits at 18,000 volts to that required by the motors, 3,000 volts, the Westinghouse people are supplying nine 400-kw oil-insulated transformers, three to each motor, capable of 25 per cent overload. Station No. 2, "La Noria," will have two 60-hp motors pumping 300 liters of water per second. Station No. 3, "Nativitas," will have two 160-hp motors pumping 600 liters of water per second. Station No. 4, "Santa Cruz," will have two 120-hp motors pumping 700 liters of water per second. Station No. 5, "San Luis," will have two 356-hp motors pumping 800 liters of water per second.

With all of the above will be supplied transformers, switchboard, lightning protection, etc., etc. The motors in every case will be 3,000 volts. The pumps as made by the Morris Machine Works of New York will be of the single impeller centrifugal type.

The layout of the stations is most complete, the pumps with their motors being set in special masonry tanks below the water level, so that the pumps are always primed. The stations are roomy and provide ample space for the high-voltage wires and transformers.

A traveling crane traverses each station, overhead, above all the apparatus to assist in assembling and handling the heavy machinery.

Insulating Compounds.

A patent issued November 6 to Mr. Samuel G. Penney describes an insulating compound which is stated to have the advantage of being durable, fire-proof, capable of being readily prepared and easily applied, inexpensive and efficient as an insulator, and which will resist concussion and vibration imparted to the metal to which it is applied and may be as conveniently and effectively used in repairs as in original application. The compound consists of fibrous asbestos, comminuted mica, a double silicate of soda

and a solution of soap, and is especially designed for insulating metallic surfaces by direct application to the surface of the metal. The silicate before application is created a double silicate by the addition of about 15 to 20 per cent of a strong solution of lime, thereby making the silicate impervious to water or any chemical change. It is also treated at the same time and in the same manner to a strong solution (15 or 20 per cent) of soap shavings dissolved in hot water, which chemically changes its stiff characteristic into pliability. The metallic surface is first coated with the silicate thus prepared, over which is then given a coating of the asbestos, which is then allowed to dry, after which a coating of the prepared silicate is again given, followed by a coating of comminuted mica. After this has dried as many additional coatings of the mica and asbestos may be given it as may be desired, dependent upon the insulating effect and insulating property needed. An outside or finishing covering or coating of paint or liquid tar paint neutralized with a strong ten per cent lime solution, may then be given.

Another patent issued on the same date to the same inventor relates to an insulating compound that may be applied either as a paint, varnish or paste to bond paper, cotton cloth, metallic surfaces or wherever a coating of insulating compound is required, and may be used either as an air-drying varnish or it may be baked on the material to be insulated in a suitable oven. The advantage claimed for this compound is that it forms a durable, fire-proof and efficient insulating coating, which is capable of being readily prepared and easily applied. As a varnish or paint the compound consists of maltha, 20 per cent; byerite, 30 per cent; benzin, 12 per cent; carbon tetrachlorid, 38 per cent. In componding these ingredients the maltha and byerite, together with a little colophony to act as a flux, are placed in a receptacle and subjected to heat until fused, and then while still hot the benzin and carbon tetrachlorid are added. The compound is then allowed to cool and is drawn off. A convenient form of maltha is the ordinary asphalt of commerce.

Concrete Telephone Poles in Indiana.

The first concrete telephone poles ever manufactured in Indiana were made during the past week by the Richmond Home Telephone Company and are now being erected to test their efficiency. The post was designed by Superintendent Bailey. A skeleton framework of four corrugated-iron rods is covered with ordinary concrete, the material being "slushed" about the framework while enclosed in a box-like mold. The pole is octagonal in shape, 30 ft. long, and provided with mortices for cross arms, which are fastened in place by means of iron bolts, and also mortices to be used by linemen in climbing. The pole is as ornamental as pine poles and has the additional virtue of being symmetrically tapered and straight. Superintendent Bailey says that the strongest point in favor of concrete poles is their durability. Wooden poles must be replaced by new ones about every six years—the dryer the soil the longer the life of the pole. The concrete poles, it is declared, will be lasting, as soil conditions do not affect them. Mr. Bailey says the cost will also be less than pine poles. The manufacture of each pole can be carried on along the line where it is to be installed or planted.

Should the experiment prove successful, this telephone company as well as many other companies, will substitute them for pine poles for all new work or as fast as the wooden poles become unfit for service.

State Railroads and Telegraphs.

In a recent interview at St. Louis Mr. George J. Gould said: "If the Government believes it can manage our railroads better than we can, and it wishes to operate them, I have no objection to selling the properties. I would sell to the Government as willingly as to an individual or company, were the lines to be disposed of, although ours are good properties and are not on the market. This is how I feel, as a railroad man, in regard to the public ownership of carriers.

"But, as a private citizen, I am opposed to the public ownership suggestion. The Government could not manage the properties successfully. Private capital or enterprise is better equipped than the Government for directing railroads and would realize successful results against failures on the part of the Government.

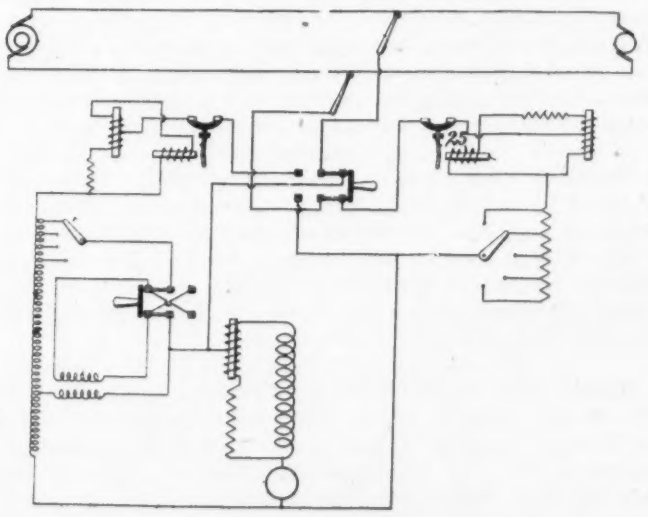
"There seems to be an impression that the Government would be superior to private enterprise, which impression is apparently founded on experience in Europe. Public ownership, or Governmental ownership, as it is more properly called in countries having a different political organization, is not the success in Europe that by some Americans it is believed to be. In fact, Government ownership is a failure in Europe.

"Italy, for example, would gladly surrender its proprietary interests and its public obligations, and it is even now taking steps to turn the State's lines over to private companies. Governmental ownership and management of the telegraph lines of Great Britain is an expensive experiment for the administration. The burden of the comparative failure of this form of Governmental enterprise rests on the taxpayers of England.

"The chief reason that State ownership of railroads prevail in Europe is the necessity or desire to provide ample precautions against the possibility of war. Europe is virtually armed at all times, and it is for the purpose of being able to control the arteries of travel in the event of hostilities that Governmental ownership of railroads is the general policy. From other standpoints Governmental ownership of carriers is not a success."

Selective Controlling Device for Alternating and Direct Currents.

The accompanying illustration shows a type of controller equipment designed for use with either direct or alternating current, and so arranged as to prevent the application of power to either of two sets of circuits of an amount or character for which it is not adapted. A double-throw switch (in the center of the illustration) serves for connecting rheostatic control circuits to the motor when direct current is used, and variable-



SELECTIVE CONTROLLING CIRCUITS.

voltage control circuits when the supply is alternating current. An overload circuit-breaker is arranged in series with the rheostatic control circuits, and a similar breaker is connected in the variable-voltage control circuits. In parallel with the tripping coil of each breaker are connected certain combined inductive and non-inductive circuits which are so arranged as to make the direct-current breaker especially sensitive to alternating current and the alternating-current breaker especially sensitive to direct current.

By means of this arrangement any alternating current which by accident may flow through the rheostatic control circuits, is caused to divide and one-half to flow through the tripping coil of the direct-current breaker, while the normal direct current is allowed so to divide that only a very small part of the total current passes through the tripping coil. When direct current attempts to pass through the variable-voltage control circuits a very large portion of the current is forced through the tripping coil of the breaker, but the normal alternating current is forced

to divide equally between the tripping coil and the circuit in parallel therewith.

Low-Pressure Steam Turbines.

So far the sphere of the steam turbine has generally been one of competition with the reciprocating engine; but, according to the London *Electrician*, Sir Alexander Kennedy, in an interesting report to the Edinburg Town Council, showed that the low-pressure turbine may be a valuable adjunct to the more old-fashioned steam engine. The problem at Edinburgh is to convert the M'Donald road station from non-condensing to condensing, and also to extend the plant. To change to condensing in the ordinary way, so as to eliminate the nuisance of steam in the atmosphere, would cost a great deal, without materially increasing the capacity of the station; and to put down additional plant of 4,800 kw non-condensing would cost £67,000. The cost of this plant, together with a change to condensing, would amount to £112,000. By putting in low-pressure turbines to use the exhaust steam, however, this additional power is obtained without requiring further boilers, and the station can be made condensing in addition with the much lower expenditure of £67,000. It will be recalled that the use of low-pressure steam turbines in connection with high-pressure reciprocating engines was discussed recently before the American Institute of Electrical Engineers, and that the turbine has found a limited application for such service in this country.

CURRENT NEWS AND NOTES.

MONORAIL.—The Behr monorail system has been taken up again and a plan has been submitted for a line from Brooklyn to Coney Island. It has been favorably considered by the Rapid Transit Commission and is now in the hands of a committee.

NEW WIRELESS TELEGRAPH SYSTEM.—A dispatch from Copenhagen, Denmark, November 15, states that Vladimir Poulsen, the inventor, has made good communication between that city and Newcastle-on-Tyne, in the north of England, with his new system of wireless telegraphy. It required energy to the extent of only 2 hp to transmit the electrical waves.

DESTROYING TREES.—Judge Alfred, of the Indianapolis Criminal Court, has fined a number of the employes of the local telephone companies for the wanton destruction of trees in the Butler College Campus in putting up wires. The companies will also come in for damages. It is said to be certain the Legislature will pass a more stringent law for the protection of trees in public highways and on private grounds.

NEW YORK ELECTRICAL SOCIETY.—The 263d meeting of the New York Electrical Society will be held at the Edison Auditorium at 44 West Twenty-seventh Street, Tuesday, November 27, at 8 p.m. Mr. Charles W. Stone, of the General Electric Company, Schenectady, will deliver an address on "Some Aspects of Modern Switchboard Engineering." Mr. Stone's grasp of his subject insures a most valuable treatment of a topic in regard to which there is far too little data and literature now available.

MUNICIPAL TELEPHONY.—Mayor Dunne, of Chicago, in connection with the settlement of the telephone situation there, declared last week that he favored a municipal telephone plant and that he would do all in his power to secure from the Legislature the authorization for the city to own and operate a telephone system. Meantime a number of prominent members of the Illinois Manufacturers' Association have protected publicly against the use of the names of that body as applying for a telephone franchise and guaranteeing the enterprise.

GREAT TROLLEY TERMINAL.—It is understood that the forthcoming report of the board of expert engineers, headed by William H. Burr and C. M. Ingersoll, which has been studying the Brooklyn Bridge crush problem for the last six months, will recommend for adoption an elaboration of the old plan of erecting a great bridge terminal on the present site of the Staats-Zeitung office and the adjoining property. The building to be erected would be large enough to house almost all of the city departments with room also for all of the trains and trolley cars which now cross the bridge. The plan proposed would cost about $8,000,000, including the cost of the land.

FLEXIBILITY OF INTERCONNECTED ELECTRICAL SUPPLY SYSTEMS.—The London *Electrician* reports an interesting development as coming from Manchester, where it is proposed to shut down the Dickinson Street generating station during the summer time, so that the other stations of the corporation may be utilized to the best advantage at a time of comparatively light loads. Naturally the town councillor finds it difficult to understand why it should be proposed to shut down a station just when powers are being sought to install considerably more plant for the winter, and suitable comments in the council chamber have been the result. The proposal is of some interest as showing the beginning of a somewhat new phase of electrical distribution for lighting in large towns in which, if several generating stations are installed, they become rather like large items of a generating plant, to be thrown in or out of service as required.

TELEPHONE WELFARE WORK.—The New York Telephone Company has awarded a silver medal at the International Exposition of Social Service at Milan, for excellence in its welfare work among employes. The telephone company's exhibit, which was installed and interpreted by the American Institute of Social Service, consisted in the main of photographs, with descriptions, showing the conditions under which the fifty-five hundred odd telephone operators work in the New York City telephone exchanges. The exhibit has been loaned by the company to Prince Cassano, of Italy, to exhibit in Rome during the height of the winter season. The exhibit was requested on account of its educational value and for its practical suggestions for those who are concerned in the promotion of improved social movements in Italy.

WIRELESS ON THE PACIFIC.—Several long-distance records in wireless telegraphy have recently been made on this coast. The cruiser *Charleston* signaled from Magdalena Bay to the Mare Island Navy Yard, 990 miles, and the Mare Island Yard has also caught messages from the Puget Sound Navy Yard intended for the cruiser *Boston*. A letter received from the Tatoosh station states that it caught a message on November 2 from the Farallon Islands, 750 miles distant. Plans have been completed for a wireless service from the mining camp at Tonopah, Nev., to San Francisco. The Occidental and Oriental Wireless Telegraph Company is establishing stations at Sacramento, Fresno, Eureka, Portland, Spokane and Seattle, and it is expected that a service the entire length of the coast will soon be in operation.

PHILADELPHIA ELECTRICAL TRADES.—The eleventh annual meeting and dinner of the Electrical Trades Association of Philadelphia was held on November 1 at the Manufacturers' Club, that city. The reports of officers showed that association to be in a flourishing condition and its value to its members, availing themselves of the use of the several forms provided, of the most substantial character. The combined membership of the several local associations, comprising the National Association, now numbers over 350 of the leading manufacturers and dealers in electrical material. After the termination of the business meeting an enjoyable social session was held. The officers and directors for the coming year are: C. E. Trump, president, representing the Novelty Electrical Company, Philadelphia; C. M. Wilkins, vice-president, representing Partrick, Carter & Wilkins Company, Philadelphia; H. G. Kepler, representing Walker & Kepler, Philadelphia; F. D. Sweeten, representing Sweeten-Crossan Electric Company, Philadelphia; T. E. Hughes, representing Standard Underground Cable Company, Pittsburg, Pa.; G. S. Smith, representing J. F. Buchanan & Co., Philadelphia; L. P. Dickey, representing Lawrence Gas Fixture Manufacturing Company, Philadelphia; E. A. Symmes, secretary-treasurer.

GOVERNMENT TELEPHONY.—It is stated that the government telephone service in Japan is so in arrears as to its work that while there is every incentive to supply as many customers as possible, the government has so far found it impossible to keep even with the demand. In Tokio alone it is estimated that some four years will elapse before the government will be able to supply an instrument to the last man who puts his name on the waiting list. Many candidates for service die before their turn comes.

WIRING OCEAN STEAMERS.—It would appear, from superficial indications that the wiring of ocean steamships is not done quite so carefully as hitherto, or as well as it should be. The *Princess Irene* has just arrived at New York reporting a serious panic due to a fire caused by defective wiring, and a similar occurrence off the coast of Ireland, on an Atlantic liner, was noted only a few days ago. "Marine work" has been taken as a synonym for the best, but the phrase at this rate may lose its meaning.

WASHINGTON BARS STEAM.—By recent ruling steam locomotives will be prohibited from entering the District of Columbia on the completion of the new union station in Washington. The Commissioners of the District of Columbia took final action on November 17 in an order prohibiting the use of anything but electric locomotives in drawing trains into the station. This applies to all railroads entering the city, and is made in the interest of the anti-smoke crusade which has been waged for several years. It is believed that in a very few years no American city of any size or importance will permit steam locomotives to operate within its limits.

THE REJUVENATED SONS OF JOVE are to hold a rejuvenation at the Revere House, Boston, Mass., at 7 p.m. on December 7, to which all Brother Jovians are invited. The rejuvenation will be conducted by Mr. Frank Booth, Jovian Statesman from Massachusetts. This order is growing and any Jovians within reach of Boston at that time will be well repaid if they take the time to attend this rejuvenation. A Jovian lunch club was formed in Boston, Mass., recently, for the purpose of meeting at lunch each Wednesday noon. The committee of arrangements consisted of Frank Booth, S. B. Condit, W. F. Hessel and Albert Mann. Twenty-six members of the Sons of Jove became members of the lunch club.

MOTORS ON LINOTYPES.—An idea of the extent to which electric motors have invaded the field of typesetting is afforded by the data of a recent inquiry. It would appear that the Mergenthaler interests have already applied motors to no fewer than 1,716 of their linotype machines. That company now builds motors into about one-third of the machines sent out. Besides this there are several hundred machines driven by individual motors purchased from outside people, and there are also many plants where a large number of machines are driven in sets by a single motor. In the aggregate this represents a large consumption of electrical energy and a large amount of dynamo electric machinery in generators and motors.

INTERRUPTING TELEPHONE SERVICE.—Because he would not or could not agree with the New York Telephone Company as to the kind of toll service and apparatus needed for his pay station business, a druggist in Harlem hacked the telephone cable that ran to his place and that also carried the wires for the adjacent block. He succeeded, of course, in interrupting the service of everybody, with great public inconvenience and distress. Yet his "public spirit" is applauded. Marvelous! This is what the vandal says: "This telephone trust is run by a bunch of robbers. I've stood their ways just as long as I can, and now I have simply used the first chance to get even. Yes, I took my hatchet and made a trip to the cellar. There I found the telephone cable that contains all the wires for this block, and I hacked the thing just as much as I could. I didn't realize at the time what a lot of trouble it would make or perhaps I might have dealt more gently with it." It is a great pity a severe example could not be made of such a person. Twelve months of the Paris telephone service would not be too great a punishment for him.

"STARTING IN LIFE" is the title of a book published by Little, Brown & Co., the author of which is Mr. Nathaniel C. Fowler, Jr. It contains over 400 pages of interesting reading matter illustrated by Charles Copeland and is intended to aid the young man or the parents of the young man who is just starting out in life, to make a wise choice of the career which the young man will follow. The success of the man is so frequently dependent upon the start of the boy that a careful perusal of this book is important. It contains chapters upon the various callings of life with comments upon those chapters written by well-known men. The manuscript of every chapter was read and approved by several authorities, all representatives of the calling treated. The chapter upon "Street Railroads" is commented upon by Mr. Herbert H. Vreeland, of New York, and Mr. Thomas E. Mitten, of Chicago; the chapter upon "The Inventor" by Prof. Elihu Thomson, of Lynn, and Mr. James M. Wakeman, of the ELECTRICAL WORLD. The book is intensely practical, it is unbiased and entirely removed from the prejudice of personal opinion. Mr. Fowler is particularly competent to present the facts contained therein; he is a composite man of success, author of a dozen books and a business adviser of international reputation.

HOME MANUFACTURING.—It has been urged frequently that one of the greater advantages of the electric motor is that it allows the artisan to carry on his work at home. There are, however, more than one aspect of the case. Prof. H. Schumacher, of Bonn University, now at Columbia University as Kaiser professor, addressed the League for Political Education last week on "Home Working in Germany." By home working he meant the carrying on of manufacturing in the homes of the workers, they being, however, directly employed by some one else. He said that this system is not a serious matter in America, but that it is carried on more extensively in Germany. There are many serious evils connected with the system, the most patent of them being that it puts all the risks of business practically on the worker. That is to say, if a particular trade is dull, and especially if it is in a really depressed condition, the man with the capital simply shuts down, having nothing to lose by such a course, and the workers are deprived of their means of livelihood entirely. Where capital is invested in buildings and machinery, the owner generally finds it advisable to keep the plant in at least partial operation, in order to avoid deterioration, thereby affording at least part time work for his employes. Under the home-working system also the employer is able to evade all responsibility for sanitary conditions, and it is impracticable for the State to exercise the control that it would in large factories.

WIRELESS SEA MESSAGES.—Discussing the recent Berlin international wireless telegraph conference, the New York *Evening Post* remarks: "The attitude of Great Britain, the greatest shipping nation, was a serious disappointment. If she had endorsed the proposal of obligatory transmission between shore and ship and all ships the success of the American delegates would probably have been complete. The English representatives fell back upon the failure to include it in the regular call, and argued that the obligation was too onerous to be imposed upon general shipping, which includes private yachts. In the licenses which will be issued by the British Government to ships with wireless outfits, this requirement of answering messages sent by any passing vessel will not be inserted. Some day, in the name of humanity alone, England must reverse her attitude; and it is safe to say that most of her ships will meanwhile readily receive and transmit wireless messages, as hitherto they have never failed to answer signals of distress or requests to report ships in trouble. To Article 8 of the agreement, that wireless "stations are bound to give absolute priority to messakes of distress from ships at sea, and also replies to such messages," England readily agreed, as did the other powers. There was also no dissent from the principle that each government binds itself to see that all stations, whether private or governmental, shall be connected with the general telegraph system by special wires or by some other expeditious arrangement."

CARBONE ARC LAMP.—In a reference to the Carbone direct-current "Radiant" arc lamp in a recent issue, the life of the electrodes was stated to be 300 hours. This was a misprint, as the life is from 30 to 35 hours.

MARCONI IMPROVEMENTS.—A cable dispatch from Rome, Italy, of November 17, states that Mr. Marconi claims that he has succeeded in producing a receiver possessing more sensibility than any previously invented, and which will practically solve the question of the dirigibility of electric waves. It will be impossible because of his new invention to intercept messages by means of other systems.

TELEPHONE COLLEGE COURSE.—The electrical engineering department of the University of Kansas has established a new course—telephone operating. A large amount of special apparatus for the course has been installed. In the course all the details of telephone operating will be taught, with opportunity for actual telephone practice. There has been a demand for this kind of a course at the university.

GOLD REFINING.—Advices from San Francisco state that Mr. Frank Leach, superintendent of the Mint, has returned from Denver, having spent some weeks inspecting the mint at that city. One of the objects of Mr. Leach's visit was the examination of the electrolytic gold refining method used at Denver. He has decided to have the process installed there, as it is a great saving of time and labor. Plans are being drawn and it will take about six weeks for the complete installation of the process.

NEW YORK TROLLEY TRAFFIC.—Officials of the New York City Railway Company state that every effort will be made to follow the recommendations of the State Board of Railroad Commissioners for a 10 per cent increase in the car service in Manhattan after November 26. They are in doubt, however, whether additional service will be possible. President Vreeland states that the road has an abundance of power and plenty of cars, but lacks 600 men, although it pays the highest scale of wages in the country. It is easy to order more cars, but not easy to man them.

BUYING COPPER COINS.—It is stated that some electrical manufacturers have lately purchased about 400,000 lb. of obsolete German pennies at 21 cents per lb. They say that this material will answer their purpose as well as electrolytic copper, now quoted at 21½ to 22 cents, for high conductivity electrical castings, as the alloy of which the pennies is made bears practically the same proportions of copper and tin as is used in this class of castings. While the possible supply of this class of copper must necessarily be small, the fact that manufacturers are using it at all, shows the effect which the present high price of refined copper has on the smaller consumers.

A SWISS NIAGARA.—A cable dispatch from Geneva of November 10 says: "An artificial cataract to be nearly 40 ft. higher than the Niagara Falls is to be constructed near here at a cost of $12,000,000, to supply Paris with electricity. It is the most important work of its kind on the European continent and has been undertaken by a company under the supervision of the city government of Paris. A barrage or dam 210 ft. high is to be built across the River Rhone at the town of Syssel, 30 miles southwest of here. This will provide the water power with which to generate electricity, which will be conveyed to Paris by overhead cables." This subject has already been noted, rather less sensationally, in our columns.

DUTCH MACHINERY EXPOSITION.—U. S. Consul F. D. Hill, of Amsterdam, and Special Agent A. B. Butman forward circulars of a proposed motor and machine tool exhibition at Amsterdam from the middle of August to the end of September, 1907. The announcement states that the Society for the Advancement of Industry (Maatschappij Van Nijverheid) has decided to organize an exhibition exclusively for the craftsman, where the most modern and best motors and machine tools used in his trade may be seen. Not only will the smaller machines and tools be exhibited, which on account of their reasonable price are within the reach of so many, but also the larger machines. The Dutch Government has placed a subsidy on the budget for 1907, while the province of North Holland and the municipality of Amsterdam have already granted subsidies. Various representatives of the most important associations of craftsmen in Holland and of the masters' unions in Amsterdam have become members of the different committees of the exhibition. The Society for the Advancement of Industry has given the charge of the organization of the exhibition to the board of the Amsterdam department. The exhibition will be held in the "Paleis voor Volksvlijt." The general secretary of the exhibition is Mr. Th. Müller Massis, Heerengracht 357, Amsterdam.

WATER TURBINE DATA.—A paper entitled "Turbine Water Wheel Tests and Power Tables," written by Mr. Robert Horton, of the United States Geological Survey, will be of interest to manufacturers throughout the country. The paper is not intended, however, as a treatise on the turbine, and comprises no extensive discussion of its theory, design or construction. It is mainly a compilation of data derived from tests and from manufacturers' power tables of American stock sizes of turbines. A bibliography has been added, giving selected references for the use of those who may wish to investigate the subject further. The primary object of the paper has been to furnish information required in the work of the Geological Survey, where the turbine is used as a water meter in gauging streams. A secondary object has been to furnish information from which the power developed at mills can be determined from the sizes and types of water wheels used. Such information is often required in the census and other water power canvasses. The water rights of mills can often be definitely determined only by the quantity of water used by the turbines which are or have been employed to develop the power. Some of these turbines are no longer built or catalogued, and it is believed that the manufacturers' rating tables and the record of tests of the older types of wheels will be serviceable to engineers who may be required to determine questions of water rights. It is believed that the section treating of the selection and arrangement of turbines in power plants will be of service to all turbine users. This report, which is listed as Water Supply and Irrigation Paper No. 180, is among the Survey's free publications.

FACILITATING LEGISLATION.—To save some of the time now lost in voting is a great desideratum in these days of overburdened legislatures. At the beginning of his career Mr. Edison took out his first patent on a legislative voting machine, and other attempts have since been made in the same direction. Mr. W. O. Stoddard, the well-known litterateur, in a letter to the New York *Tribune* on the subject, deplores the waste of time and energy and says: "The complete remedy is at once apparent. It consists of two or more upright discs, to be placed in full view near the speaker's chair, connected by a suitable electric apparatus with the desk of each member. The appliances, of every kind, might be readily devised by any of our electricians and the cost would be insignificant. Without rising from his seat, without the waste of a needless minute of the time of the House, each member present could record his vote by a mere touch of his finger upon a button. On leaving his seat, for any cause, he could lock up the button, so as to be sure that no enthusiastic friend should vote for him in his absence, as some of them might be willing to do. The record thus made would be perfect, permanent and unassailable. As time goes on the rapidly increasing volume of legislative business calls more and more loudly for some practical relief. Here is a means for adding 40 per cent to the working hours of each session without increasing its nominal length. It would not be pleasant to inquire how much injurious neglect of important public affairs has already been directly caused by this antiquated relic of stupidity and semi-barbarism. A reform ought to be obtained at once, for there is nothing really sacred in these comical processions of legislators running the gantlet or walking the plank. Undoubtedly, the idea here set forth must have occurred to a great many other observers. I wish there were a hundred thousand of them, each with time and a meddlesome spirit, to write to his representative and urge him to act in this matter like a reasonable, sound-minded business man."

Station of the Wilkesbarre Gas & Electric Company at Wilkesbarre, Pa.

THE Wilkesbarre Gas & Electric Company, of Wilkesbarre, Pa., is a consolidation of the Luzerne County Gas Company, the Wyoming Valley Electric Light, Heat & Power Company and the Ashley Electric Light, Heat & Power Company. The Old Wilkesbarre Electric Light Company was an original licensee of the Edison Electric Light Company. The first central station was built near the electrical center of the town and was placed in operation in 1887. The limits of capacity of the location and station equipment having been reached, the present station was built in 1895 on the bank of the Susquehanna River. This location at the time had several excellent points in its favor. There was an abundant supply of low-grade fuel in a large anthracite culm bank immediately surrounding the station, and which was obtained at a nominal price per ton. Water for feed and condensing purposes could be taken from the river and a large space was provided outside the power house for the dis-

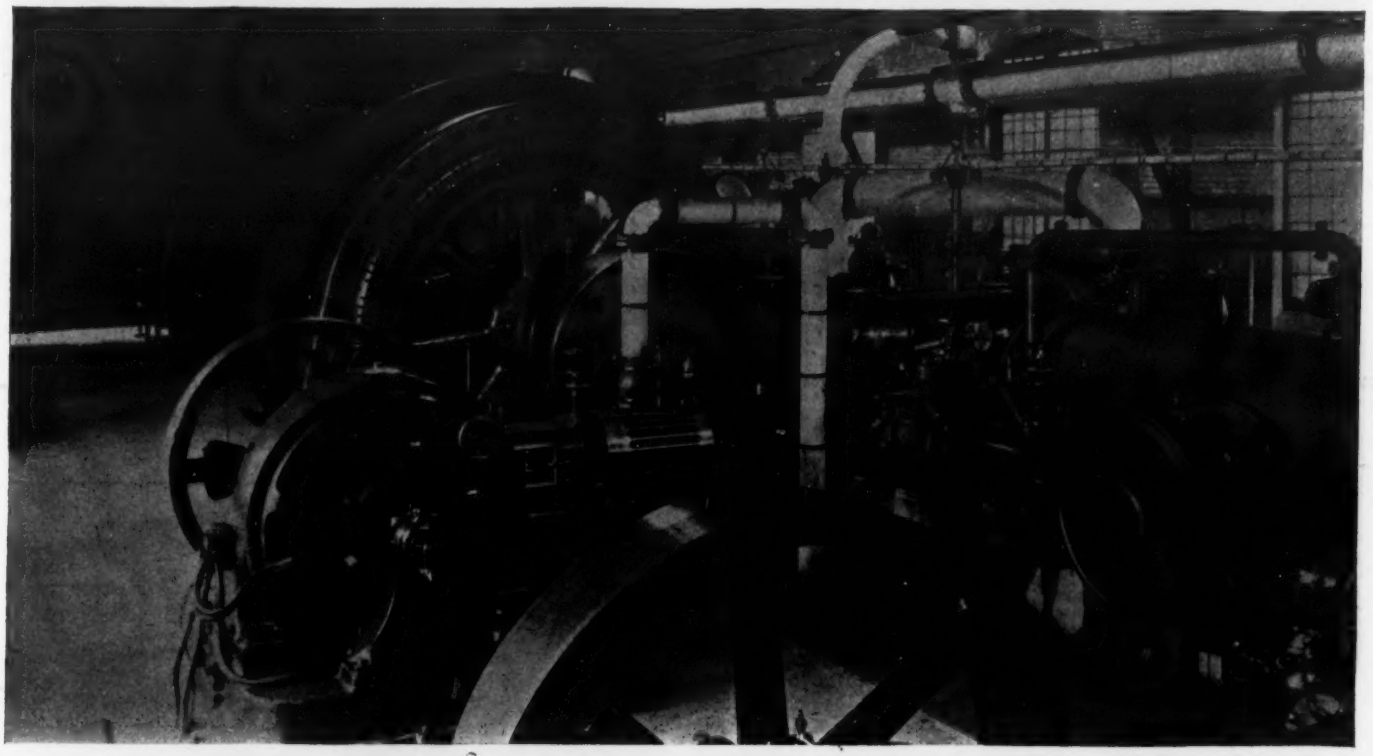


FIG. 1.—ONE CORNER OF DYNAMO ROOM, WILKESBARRE GAS & ELECTRIC COMPANY.

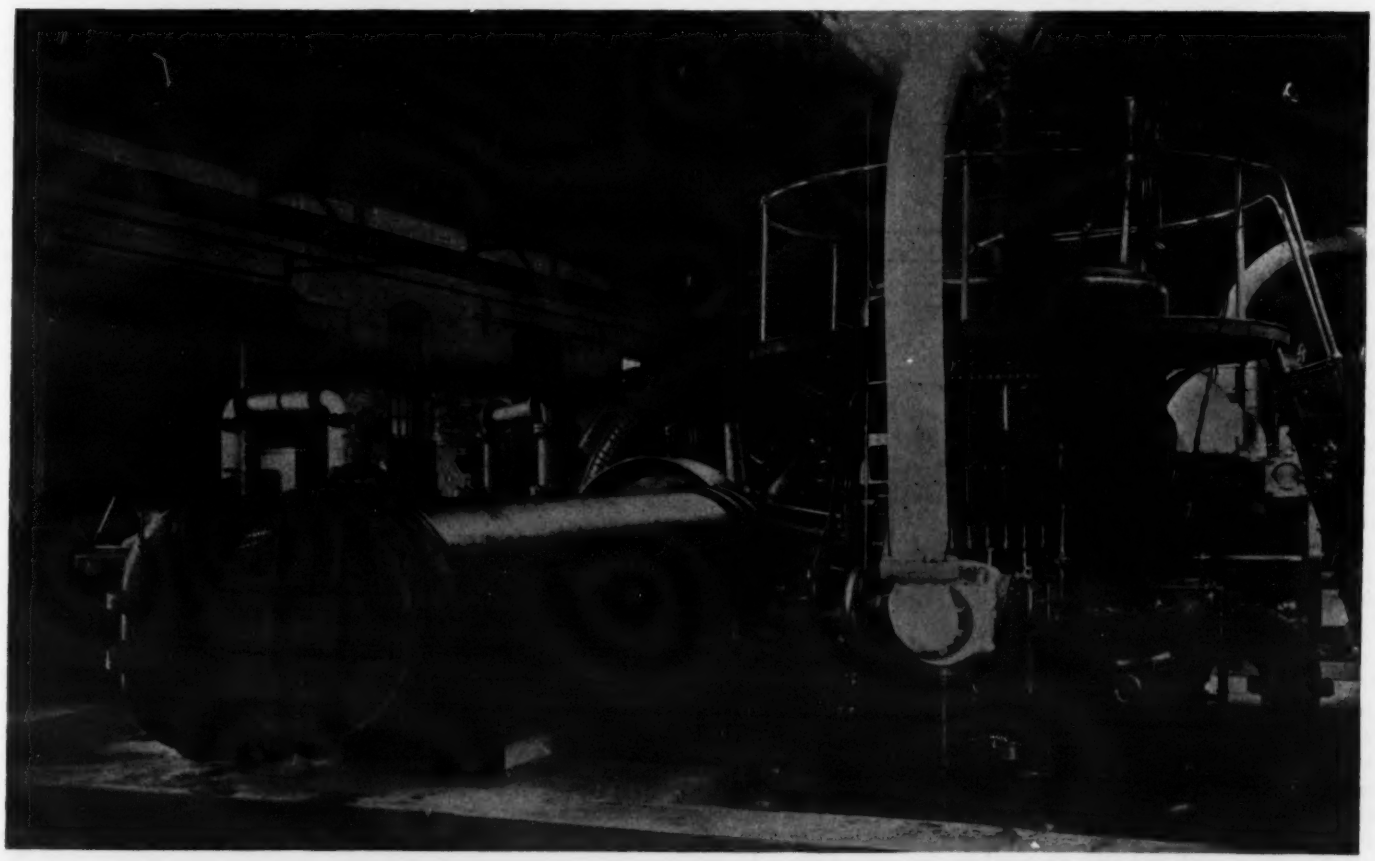


FIG. 2.—TURBO-ALTERNATOR UNIT AND SURFACE CONDENSER.

posal of ashes. The latter two conditions still prevail, but culm is no longer used, buckwheat anthracite being now burned.

The electric light station, a view of which is given in one of the engravings, is of nearly fire-proof construction. The design of the building and arrangement of the plant were prescribed by the dimensions of the property coupled with the necessity of obtaining secure foundations on bed rock. The boiler room is designed to conveniently accommodate 2,000 hp of water-tube boilers. Ample space is provided for convenient passage all around the boiler batteries for cleaning purposes, and the firing space between batteries is 20 ft. wide. A coal storage reservoir system with automatic coal delivery is installed above this space.

The exceedingly low cost of fuel was a feature that at the outset of the construction was carefully and repeatedly analyzed

FIG. 3.—DISPLAY IN OFFICE WINDOW.

in order to compare the original cost and economies that would be obtained by the use of the many appliances generally utilized for the saving of fuel. As a result some types of apparatus that would be beneficial in other stations, differently located and paying a higher price for coal, were found to be of but little value in this station. The arc system was driven by two Armington & Sims engines, and in addition to these there were in use two Payne engines, three Ide engines, one Ball engine and one Armington & Sims engine. These were found to be in such excellent condition that it was not considered desirable to dispose of them at the time. The low price of coal warranting this until such time as large increase of business demanded greater capacity. For this reason also most of the old electric equipment from the original plant was used in the new station.

The station as then built was typical of the practice of the day, containing a large number of small generating units which was added to as the business of the plant grew. These additions resulted, as such growth inevitably does, in the case of an old style plant, in the multiplication of machinery types and a conglomeration of small generating sets to such an extent as to overcrowd the station building and render operation difficult, so that the company last year decided to reconstruct the entire station as well as the system, thus modernizing the entire plant. The work of making the changes was placed in the hands of Messrs. J. G. White & Co., who proceeded to bring the plant up to the standard of the latest practice.

The electrical equipment at the time of the change consisted of Stanley 60-cycle, two-phase, belt-driven alternators and one General Electric 60-cycle alternator. There were in addition two 50-light T.-H., two 50-light Edison, one 100-light, one 150-light and six 50-light Excelsior arc machines, all belt-driven. At the sub-station on North Washington Street there were two Excelsior, two Ft. Wayne and two Siemens & Halske compound rotaries, each of 100 kw capacity and converting two-phase, 60-cycle current into direct current at 125 volts. Fully 75 per cent of the service was supplied with direct current received from these rotaries and from two 150-kw, 60-cycle motor-generator sets, the motors of which were supplied with 2,200-volt alternating current and the generators delivering direct current at a potential of 230 volts. The rotaries were operated in pairs with the neutral off the center, and the motor-generator sets were operated on the outside of the three-wire system.

The present boiler plant consists of seven 225-hp Stirling water-tube boilers. These burn No. 2 buckwheat coal, the blast being supplied by a steam-driven blower. It is a curious fact that although the station is in the heart of the anthracite coal regions and two railroads pass the station, No. 3 buckwheat coal cannot be obtained in sufficient quantities. The reason for this is that there is such a demand for this size of coal in the large cities that the railroad companies prefer to make the freight on its shipment than to dispose of it to local industries. Water for boiler feed purposes is taken from the Susquehanna River.

The present electrical equipment consists of one 500-kw and one 600-kw, two-phase, 60-cycle, 2,300-volt, General Electric alternator direct-connected to Allis-Chalmers compound condensing engines, and one 750-kw, 60-cycle, 2,300-volt, General Electric turbo-generator. There are two 50-kw steam-driven exciter sets provided and one 20-kw motor-generator set. An Alberger jet condenser is provided for the engine sets, and an Alberger surface condenser for the turbine set. Water for condensing purposes is taken from the Susquehanna River as follows: A 36-in. cast-iron intake pipe extends from the shore out to the middle of the river a distance of 380 ft. The end of the pipe line is protected by heavy crib work. From the shore to the deep well beneath the power house the distance is about 200 ft., making in all about 580 ft. from the crib work to the station. The well is about 45 ft. deep. Suction pumps deliver the water

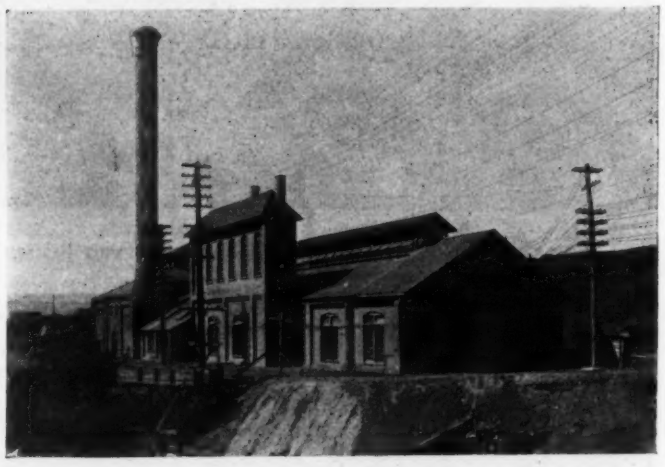


FIG. 4.—EXTERIOR VIEW OF THE ELECTRIC LIGHT STATION.

in an 8-in. pipe line for feed water purposes and in a 12-in. and a 20-in. line for condenser purposes. The condenser overflow is permitted to run to waste. The reason for extending the intake far out into the middle of the river was for the purpose of obtaining clean water since every little creek and stream which empties into the Susquehanna River about Wilkesbarre is black with culm, etc., from the washeries along their banks.

The entire sub-station equipment has been changed with the exception of the two 150-kw motor-generator sets. Direct current at 115 volts is no longer supplied, and while the 220-volt, direct-current supply is still retained for large motors, nothing is being added to the direct-current system. In the space formerly occupied by the six compound rotaries are five 100-light, 7½-amp., 60-cycle, constant-current transformers. The arc lighting system has been changed from 9.6 amp. Excelsior open arc lamps to 7½ amp. General Electric enclosed arcs. Entirely new switchboards were erected in the sub-station and in the main station and these conform to the latest General Electric practice.

The distribution and feeder system is entirely overhead. The total connected load approximates 3,100 kw, of which about 700 hp is motor load, 325 kw street lighting load and the remainder is incandescent lighting load. The rate for arc lamps is $60 per annum, burning every night and all night. The rate for motor service ranges from 7 to 3 cents per kw-hour and the rate for lamps ranges from 11.6 to 4½ cents, according to the kilowatts demand. This is ascertained by inspection and is based on the installation. The demand for residences is taken at 40 per cent of the installation; the demand for hotels is taken at 75 per cent

of the installation and in business places the demand is taken at 90 per cent of the installation. Motor user's demand is taken as that of the installation unless tested. No demand meters are installed, and all customers are supplied through a meter. A flat rate sign schedule is in use, the price depending on the number of lamps used and the hours of burning. Time switches are used in connection with these signs. There are not many signs in use in Wilkesbarre, 25 at the most. This is due to an ordinance prohibiting the use of signs over the sidewalk, which ordinance it is expected will be shortly revised.

The business-getting department of the company is presided over by a manager, and three solicitors are employed in addition. The solicitors are paid a salary and a commission, the latter being based on the kilowatt demand connected. The company issues no printed matter, but has a follow-up system of advertising in newspapers. Personal solicitation is depended on chiefly for new business. A card record system is kept of every house in Wilkesbarre whether supplied with electricity or not. The non-customers are differentiated from the customers by a difference in the color of the card. This system of business getting has been in use only since 1906 and in seven months the increased load was 700 kw.

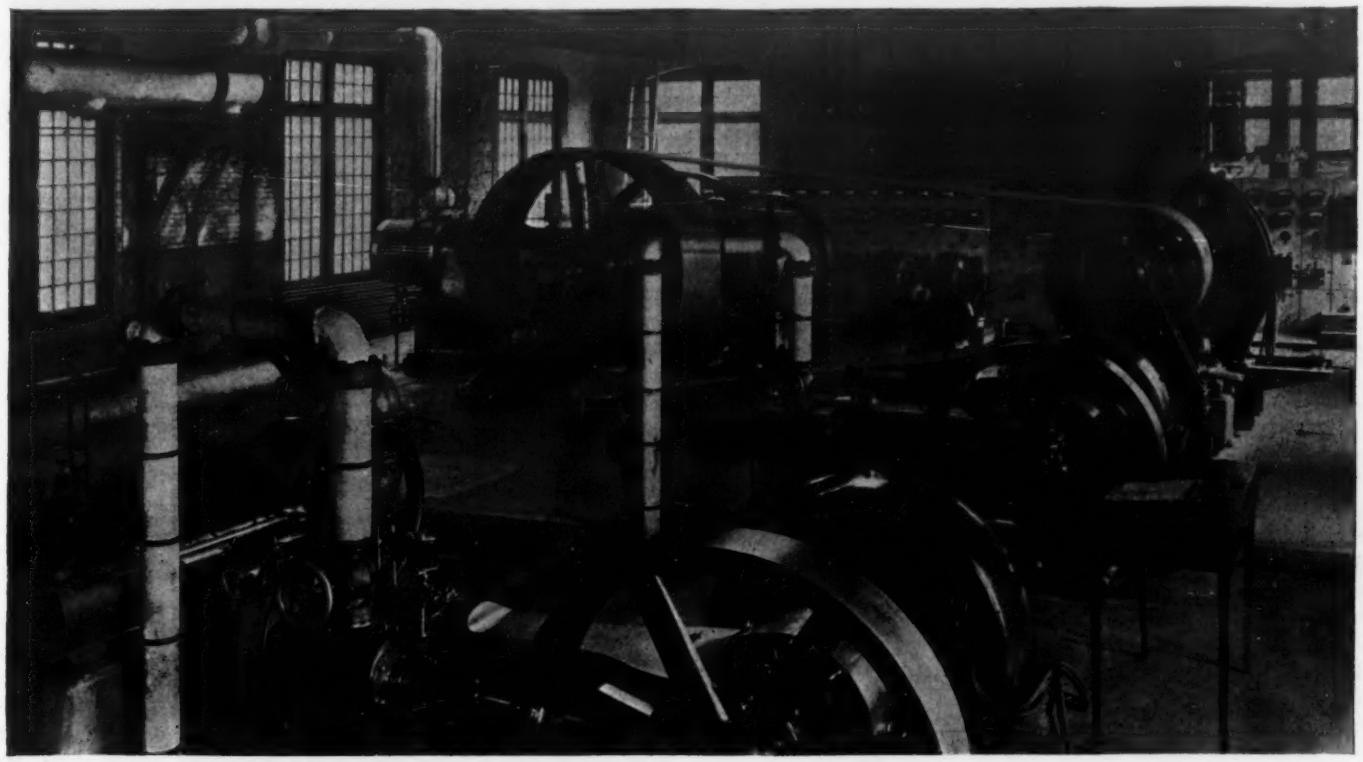


FIG. 5.—ONE END OF DYNAMO ROOM, SHOWING SWITCHBOARD.

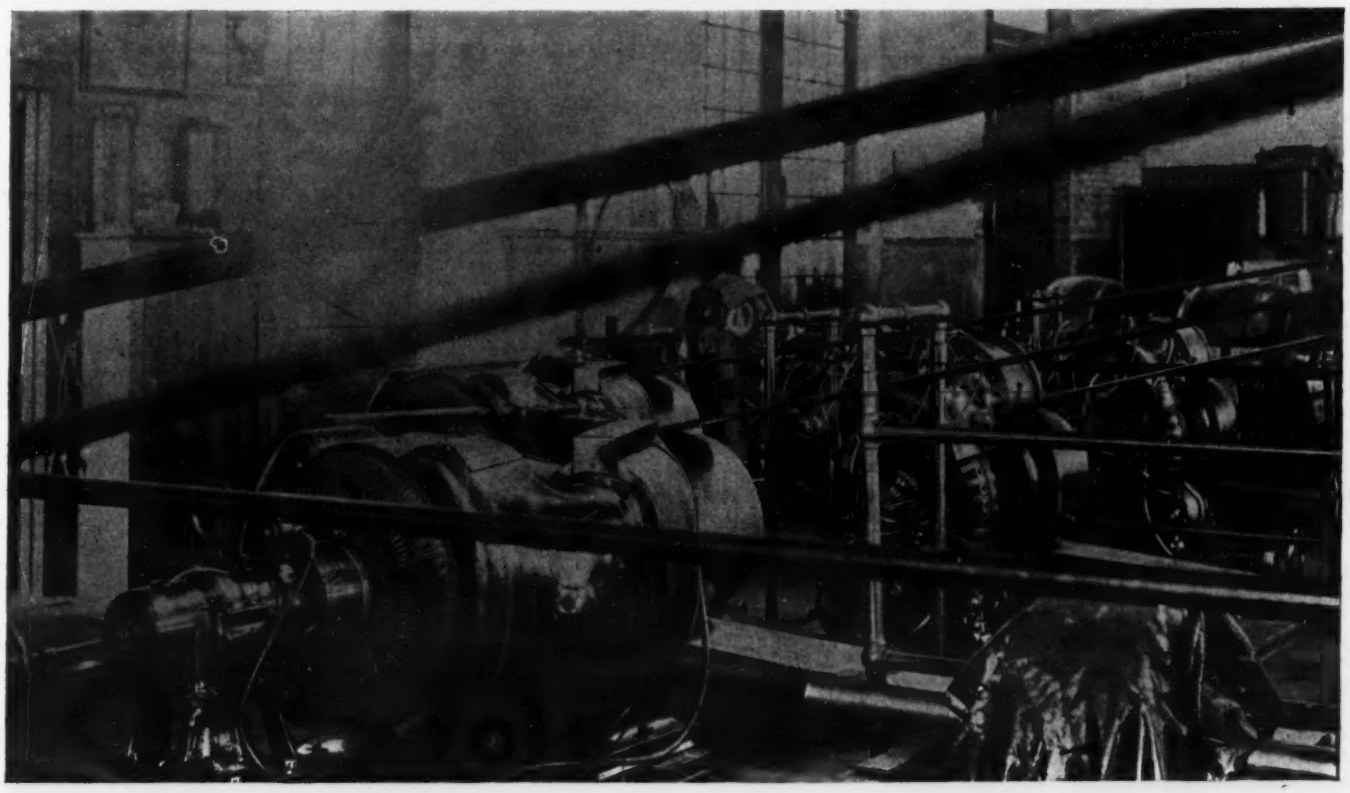


FIG. 6.—VIEW OF DYNAMO ROOM BEFORE RECONSTRUCTION, SHOWING BELTED ARC LIGHT MACHINES.

The Carborundum Wireless Detector.

By Greenleaf W. Pickard.

A wireless detector, consisting essentially of a carborundum fragment, has been developed in the past year by General H. H. C. Dunwoody, of the American DeForest Wireless Telegraph Company. As this detector has lately been the subject of discussion in the Electrical World, it is thought that the following description of the detector and its mode of operation will be of interest.

Early in the present year the writer experimentally investigated the carborundum detector, to determine the principle of operation, and the best form for commercial use. As the result of a long series of experiments, the most sensitive and stable form was found to be a single crystal, clamped edgewise between two flat copper terminals. This form is shown in Fig. 1, with the local circuit of telephone receiver and potentiometer, the terminals, *AA*, being connected to the receiving circuit.

It was soon observed that this detector, like the electrolytic receiver, operated best at a certain critical potential in the local circuit. Placing in series with the detector a D'Arsonval galvanometer, and in shunt to the detector terminals a Dolezalek electrometer, a series of readings were taken of current and potential, at different values of the former. Reducing these readings to resistance of the detector at different current strengths, the curve shown in Fig. 2 was plotted. It will be observed that for very small current values, of the order of a few microamperes, the resistance of the detector is very high, being of the order of a megohm. From the slope of the curve at this point, it would seem that the resistance of the detector would be practically infinite to an infinitesimal current. As the current increases, however, the resistance falls off very rapidly. The resistance change with increasing current is better shown as a conductance change, and this is also plotted in the curve, in reciprocal megohms, or micromhos. It will be noticed that the conductance plots as a slightly curved line, showing that within the limits given in this plot, the conductance varies nearly in direct proportion to the current.

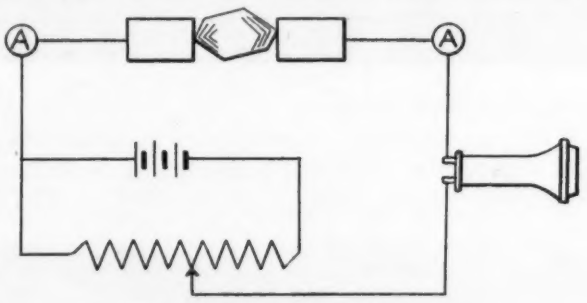


FIG. 1.—CARBORUNDUM DETECTOR.

In Fig. 3 the conductance of the detector is plotted against the potential difference across its terminals. In this curve the range is somewhat greater than in the preceding, and it will be seen that the conductance varies most rapidly between 1.0 and 1.1 volts. At this potential, the conductance of the detector is about 250 micromhos, or 4,000 ohms, and a variation of 0.01 volt at this point will cause a conductance change of about 10 micromhos, or 4 per cent. When the detector was inserted in a wireless receiving circuit, the maximum response was obtained with a potential of from 1.0 to 1.2 volts in the local circuit, which affords an excellent check on the accuracy of the curve.

When the copper terminals of the detector were heated from an external source, the resistance of the detector was found to fall greatly, but to rise again to the original value on cooling. It is well known that carborundum has a high negative temperature coefficient of resistance, this property being utilized in the form of a carborundum resistance for starting induction motors. From the above results it would seem that the carborundum detector varied its resistance because of Joulean heating at the contact, the resistance being lowered by such heating.

It is an interesting characteristic of carborundum that the flat surfaces of the crystals possess but little conductivity, good electrical contact being obtained only along the thin edges of the crystal. When clamped between flat terminals, this limits the area of electrical contact to a very small surface, probably less than one-millionth of a square inch in area; and, because of this limitation, the heating effect of the local battery current and the superimposed received oscillations is confined to a small mass of carborundum, a tiny pyramidal block, perhaps a thousandth of an inch on a side, and containing less than a billionth of a cubic inch of carborundum. For such a mass a small fraction of an erg would suffice to raise materially the temperature, and therefore its conductance.

It would seem that the carborundum detector must be classed with bolometric receivers. Instead, however, of an extremely fine metal wire, of relatively low specific resistance and temperature coefficient, as in the Fessenden hot-wire barretter, the carborundum detector employs a constricted current path in the form of a crystal point or edge contact with a plane surface, of material having a high specific resistance and temperature coefficient.

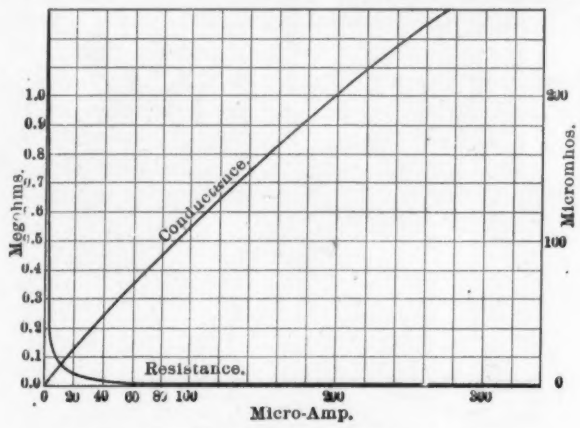


FIG. 2.—CONDUCTANCE AND RESISTANCE CURVES.

In the matter of sensitiveness the carborundum detector compares favorably with the microphonic contact type of detector, as, for example, the well-known carbon-steel microphone. It is not, however, nearly so sensitive or constant in its action as either the electrolytic or magnetic detector.

The following short table shows the amount of energy, in microergs, required to give a just audible dot with the different detectors.

Electrolytic	364 to	400	microergs
Magnetic	400 "	400	"
Carborundum	9,000 "	14,000	"

In the practical use of the carborundum detector, the difference in sensitiveness does not seem as great as the numerical values of the table would indicate. The reason for this lies in the human ear, which does not estimate differences in sound intensity directly, but rather as the ratio of the square roots of the intensities of the two sounds.

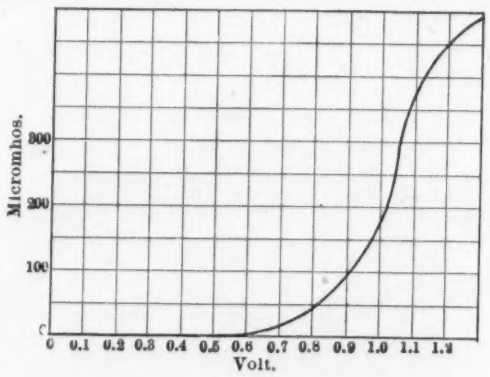


FIG. 3.—CONDUCTANCE CURVE.

It is further to be pointed out that the commercial sensitiveness of any detector depends largely upon the type of receiving circuit employed. Owing to the large differences in impedances between different types of detectors, it is extremely important that the received energy should be delivered to the detector terminals in a suitable form as regards current and potential relations. Where oscillation transformers are employed for the

coupling of the detector to the receiving circuit, this may be done by varying the ratio of transformation and the coefficient of coupling.

The writer is of the opinion that many of the so-called comparative tests of wireless detectors are valueless, from disregard of the above considerations.

Electrical Ignition in Internal Combustion Engines.—I.

By F. W. Springer.

DURING the course of an extensive study of the methods employed for igniting the explosive mixtures in internal combustion engines, the writer had occasion to investigate the phenomena involved in ignition by electrical means and to determine the most advantageous features to be embodied in the construction of apparatus for this purpose. It is believed that a brief review of this work will prove of interest to electrical engineers.

The electrical methods employed in ignition may be divided into two classes, the contact-spark or touch-spark and the jump-spark. The former method, which is variously called the "make-and-break," "hammer-break," "snap-break" or "wipe-spark," is the simplest, most reliable and most economical method for moderate speed engines. The latter method, which involves the use of a vibrating (or non-vibrating) induction coil, is frequently employed on high-speed or variable-speed engines. These two methods will be treated separately.

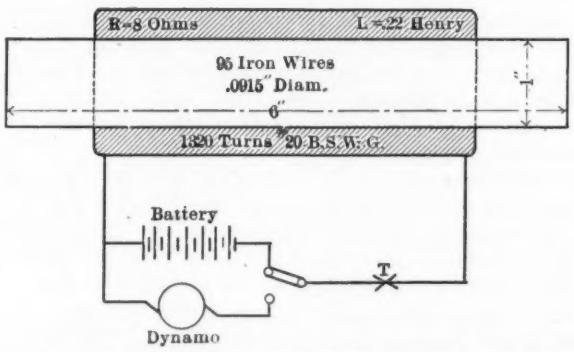


FIG. I.—TOUCH SPARK COIL USED IN MOST OF THE EXPERIMENTS.

TOUCH SPARK.

In operating the touch spark the apparatus is connected as shown in Fig. 1. Contact is made between the spark points at

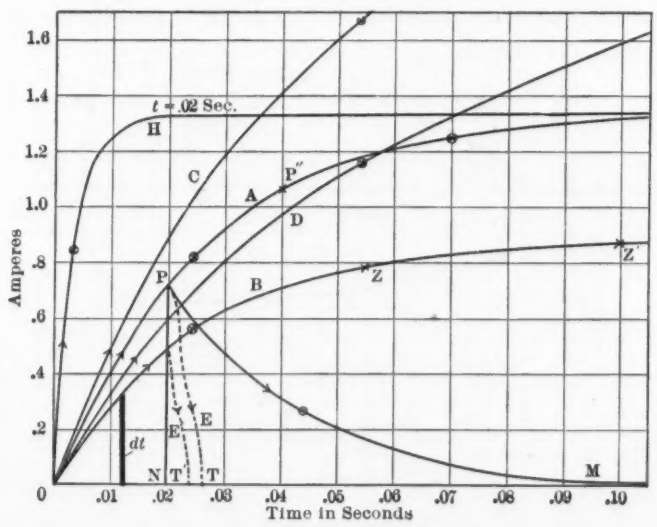


FIG. 2.—CURRENT-TIME CURVES.

T for a definite part of a revolution, and then the connection is broken with a snap, drawing an arc of from 1/16 in. to 5/16 in. in length.

On closing the circuit at T the current flows in the circuit in an increasing amount, the e.m.f. caused by the lines of force expanding and "cutting" the turns of wire opposing the building up of the current, so that it takes theoretically an infinite time for the current to reach its final value of $\frac{E}{R}$ where E is the e.m.f. of the source of the current and R is the total resistance in the circuit, including the internal resistance in the cells and all connections.

The form of the current growth curve is logarithmic, the equation being:

$$I = \frac{E}{R}\left(1 - \epsilon^{-\frac{R_t}{L}}\right) \qquad (1)$$

Or, since ϵ is the base of the Naperian system of logarithms, and is equal to 2.71828, we may write:

$$I = \frac{E}{R}\left(1 - \frac{1}{2.718^{\frac{R_t}{L}}}\right), \qquad (2)$$

in which I is the current at the end of any time, t, reckoned from the instant of closing the circuit, R, the total resistance in the circuit, E, the open circuit e.m.f. of the battery, and L, the total self-induction of the circuit in henries. The accompanying table gives the data upon which the curves of Fig. 2 have been based. In case a dynamo is used instead of a battery, L includes the self-induction of the dynamo and the coil. Ordinarily the self induction of a dynamo is only a few hundredths of a henry, but it may be made large enough so that no other coil is needed.

Curve.	Volts. E	Ohms. R	Coef. L	Sec. t	$T=\frac{L}{R}$	I at $t=.02$	Stored magnetic energy. J	I $max.$	J $max.$
A	12	9	.22	.02	.0244	.72	.057	1.33	.195
B	8	9	.22	.02	.0244	.48	.025	.89	.087
C	12	4.5	.22	.02	.0488	.9	.089	2.67	.781
D	8	4.5	.22	.02	.0488	.6	.040	1.78	.348
H	108	81.	.22	.02	.0027	1.33	.194	1.33	.195

Since the magnetic circuit of spark coils is composed of both iron and air, the permeability of the two combined depends on the relative amounts of magnetic reluctance in the two parts. In most cases the permeability will vary not more than a few per cent within the working range of current, so that it will not be far wrong to use an average value of L in all calculations.

If the e.m.f., E, of the circuit could be eliminated at some point, as P (Fig. 2), without changing R, or any other condition, the current would die out, decreasing on the logarithmic time curve, M, the equation of which is:

$$I = \frac{E}{R} \cdot \frac{1}{2.718^{\frac{R_t}{L}}}, \qquad (3)$$

in which E' equals the current at point, P, multiplied by R. This curve indicates the discharge of the energy stored magnetically in the coil in setting up the current to some point, as P. The numerical value of this magnetic energy, or core energy, is

$$J = \frac{LI^2}{2} = \frac{L}{2}\left[\frac{E}{R}\left(1 - \epsilon^{-\frac{R_t}{L}}\right)\right]^2 \qquad (4)$$

in which J is the work in watt-seconds or joules, and I is the current at the moment considered.

One coil may be said to operate faster than another when the time constant $\frac{L}{R}$ of the first is less than that of the second coil. Further, increasing the self-induction of a circuit increases the time required for the current to rise to a certain per cent of its full value. Moreover, decreasing the resistance would decrease the rate at which the current increases (if expressed in per cent of the full value), but it would increase the maximum value of the current to such an extent as to more than compensate for the slow growth expressed in per cent. Curves A and C of Fig. 2 illustrate this, A being the faster coil; similarly B is faster than D, as expressed in per cent; curve H is for a much faster coil than curve A (see table Fig. 2). The time constant, however,

has little significance unless considered in connection with the voltage and the resistance.

In plotting such a curve as *A* (Fig. 2), there are three points on the curve which can be determined without the use of the equation for the building up curve, i. e., at $I = 0$; at I equals 63 per cent $1 - \frac{1}{e}$ of $\frac{E}{R}$ when $t = T = \frac{L}{R}$ and at $I = \frac{E}{R}$ (almost) when t equals 5 times T. For approximate comparison these points are sufficient to draw the curve, otherwise a few intermediate points may be calculated by substitution in equation (2); for example, to find the current at $t = .07$ second

$$I = \frac{12}{9}\left(1 - \frac{1}{2.718^{\frac{9 \times .07}{.22}}}\right)$$

$$I = \frac{12}{9} \times .993 = 1.25, \text{ as at } X, \text{ curve } A, \text{ Fig. 2.}$$

It is evident that the current, I, varies directly as the voltage, other conditions being constant, so that having given one curve, the curve for another voltage can be plotted by simply changing the ordinates in the ratio of the voltages. The unbuilding curve, *PM* (Fig. 2), is plotted by solving for the value of I at any time t, by substituting in the corresponding equation. The time, t, is

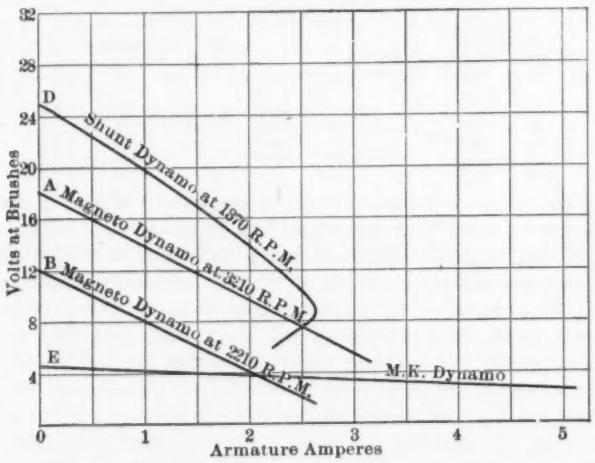


FIG. 3.—EXTERNAL CHARACTERISTICS OF IGNITION DYNAMOS.

reckoned in seconds from point, *N*, Fig. 2, as zero time, and *E* is equal to the ohmic drop in the coil at the point of cut-off, *P*. All the curves in Fig. 2, as a study of the table (Fig. 2) will show, are based on the following conditions; the use of the same coil (so as to have the same *L* throughout) and on the use of different sources of current having different voltages and resistances. A comparison of the curves will bring out among other things the following: The lower the resistance and the higher the e.m.f., the larger will be the current, and, since the core energy varies as the square of the current, the larger will be the core energy and the larger the spark.

Such curves as those shown in Fig. 2 will be found not to agree accurately with those obtained under the same conditions by means of an oscillograph, the reason being that an average value is used for L in the calculations, so that the actual curve would be a little steeper at the start (since *L* is smaller for small values of current), and it would be a little flatter at the larger current values. The form of the current curves may also be somewhat affected by the iron losses of the core, namely by eddy currents due to insufficient lamination of the core, and by hysteresis which depends upon the magnetic qualities of the material.

There is another condition which may affect the shape of the growing curves, as *A* (Fig. 2), and in practice is very important. This is due to the fact that in general the voltage of dynamos falls with an increase in current due to the armature reaction on the poles, and, in the case of shunt dynamos, also to the resistance loss of voltage in the armature. As a result, if a dynamo be used instead of a battery, the curve might start as on *A* (Fig. 2), with 12 volts, and because of the decrease in voltage, finally reach curve *B*. The drop in voltage is usually quite proportional to the armature current, so that it is an easy matter to change the ordinates of such a curve as *A* in the ratio of the actual voltage of the dynamo to the open circuit voltage for each value of the current. The polarization in a battery has somewhat the same effect, although it is complicated by a coincident increase in the resistance.

The above described reaction of a dynamo such as the magneto,

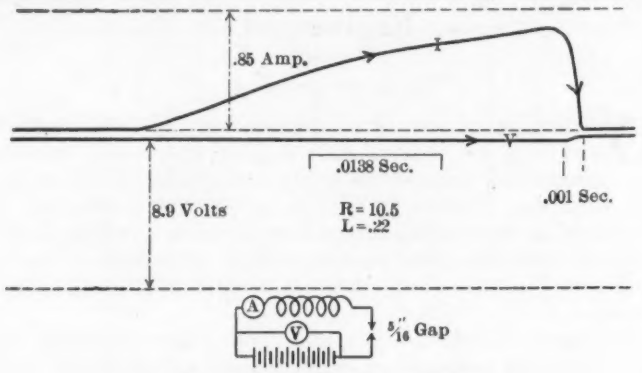


FIG. 4.—OSCILLOGRAPH RECORD.

whose external characteristic curves are shown in Fig. 3, may be a distinct advantage in touch-spark and non-vibrating jump-spark ignition, as it enables the use of a high voltage to overcome the resistance of poor contacts in the engine, and does not give too large a current at high engine speeds when the open circuit voltage of the dynamo is high.

The actual curve of the dying-out current is in general not at all like (the ideal curve) that shown in curve *PM* (of Fig. 2), because the conditions in the circuit are entirely changed by the opening of the spark-gap in the engine. The resistance of the circuit is increased by the resistance of the arc, which in turn varies with the length of the arc, the nature of the terminals, the gas pressure in the engine cylinder and the current. The arc resistance becomes infinite when the arc breaks. The introduction of this variable resistance would effect a quick discharge of the core energy, the current falling on such a curve as *PET*. The form of the top of this curve, near P, depends to some extent upon the quickness with which the spark terminals separate; and the bottom of the curve would take a form depending upon the point on the current curve, *PET* (Fig. 2), at which the arc broke.

As a result of the discharge of the magnetic energy, *J*, which is equal to $\frac{LI^2}{2}$, I being the current in amperes at point P, the magnetic lines of force close up in such a way as to tend to keep

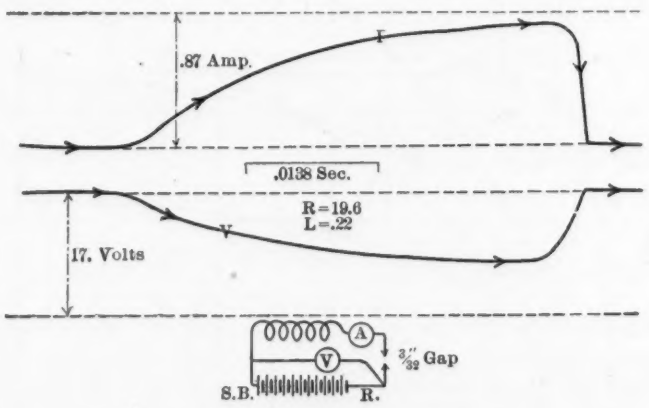


FIG. 5.—OSCILLOGRAPH RECORD.

the current flowing. There are thus two e.m.f's tending to maintain the arc, that of the battery and the self inductive e.m.f. of the coil. The latter is momentary and many times larger than that of the ordinary battery. Figs. 4 to 8 were taken while using the coil shown in Fig. 1 under the condition specified in each case. A Duddell high-frequency double oscillograph was used with a flying photographic plate, the circuit being closed by the

plate holder for the time indicated on each record. The positions of the oscillograph strips are shown in diagram at *A* and *V*.

It is evident that the discharge curve, *PET*, Fig. 2, might be prolonged, i. e., *NT* increased and the arc might hold indefinitely if the battery voltage were large enough as in Fig. 6. The arc, however, is always drawn to sufficient length, and there is always sufficient resistance placed in the circuit so that the arc usually breaks a little before all the core energy is discharged,

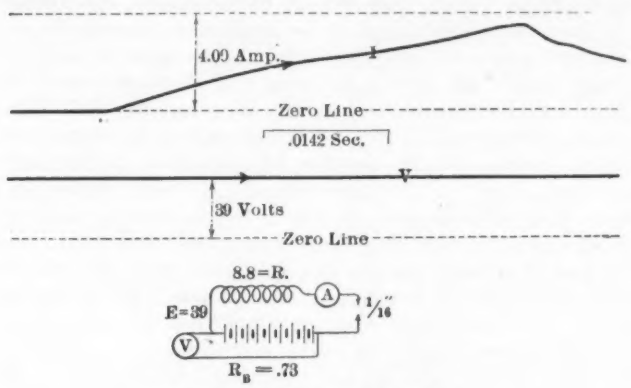


FIG. 6.—OSCILLOGRAPH RECORD.

giving the typical curve shown at *PET* (Fig. 2). The quickness of the discharge in air is shown in the current curves in Figs, 4, 5, 7 and 8. With the coil used in the tests the speed of discharge seems to be largely a matter of the speed of opening the gap.

The correct length of the gap to be used in an engine is best found by trial, setting the stop first to obtain the shortest possible gap, and then the longest, and adjusting the gap, finally, as a mean between the two, favoring a short gap to allow for the subsequent burning away of the terminals, and to prevent hammering.

In a test on a single-cylinder White engine, no difference in the operation of the engine could be detected when changing the spark-gap from 1/32 in. to 5/16 in. in length, using six small dry cells and the coil shown in Fig. 1.

The best length of arc for a touch-spark coil, as already stated, can probably be best determined by trial. Changing the length of the arc changes its nature, i. e., a long gap causes the arc to discharge more rapidly, resulting in a higher voltage and generally a smaller current. The long arc probably involves more vapor in the initial explosion and is more disruptive in character.

The best length of arc, therefore, depends upon the nature of the terminals, the speed in opening the spark-gap, the engine compression, the kind of spark coil and the voltage of the source

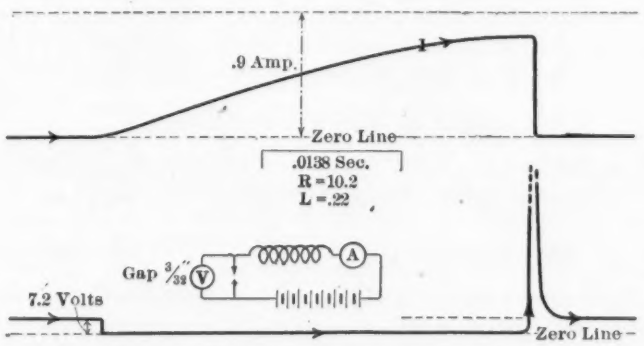


FIG. 7.—OSCILLOGRAPH RECORD.

of the current. The length of arc which can be maintained with a certain current varies with the nature of the terminals and the compression.

The areas, *OPT* and *OPT'* (Fig. 2), represent the ampere-seconds or coulombs expended per explosion with 12 volts and 8 volts, respectively.

By means of a planimeter, the area, *OPT*, was found to be equal to .0102 ampere-seconds and *OPT'* equal to .0063.

If the engine were to run at one-half the speed assumed in Fig. 2, or at 312 r.p.m., the time of contact would be .04 seconds, and the current would be 1.075 amp., as at point *P* in curve *A* of Fig. 2. There would then be 0.333 amp.-seconds per explosion, of which there are $312/2 \times 60$, or 2.6 per second. The amp.-seconds per explosion multiplied by the number of explosions per second gives the amp.-seconds per second or the average current demand in amperes, or $2.6 \times .033 = .086$ amp. This is the average demand made upon the battery. On comparing this with the current taken at 625 r.p.m., it is seen that in reducing the speed by one-half, the average battery demand has been increased from .054 amperes to .089 amperes. So that in general the slower the speed of an engine which uses the touch-spark at constant voltage (or the non-vibrating jump-spark system) the greater will be the demand on the battery, and the chemical energy per explosion will be very much greater when the point of the cut-off comes at a lower rather than a higher point on the current curve at full engine speed.

The energy stored in the magnetic circuit of the coil at any point, as *P* on the building up curve, *A*, of Fig. 2, is $J = \frac{L}{2} I^2$, where J = energy in watt-seconds, L = coefficient of self-induction of the coil in henries, and I = current in the coil. When cut off at point *P*, $J = \frac{.22}{2} \times .74^2 = .06$ watt-seconds. At *P'*, using 8 volts and the same coil and same resistance and time of contact, $J = \frac{.22}{2} \times .395^2 = 0.27$ watt-seconds.

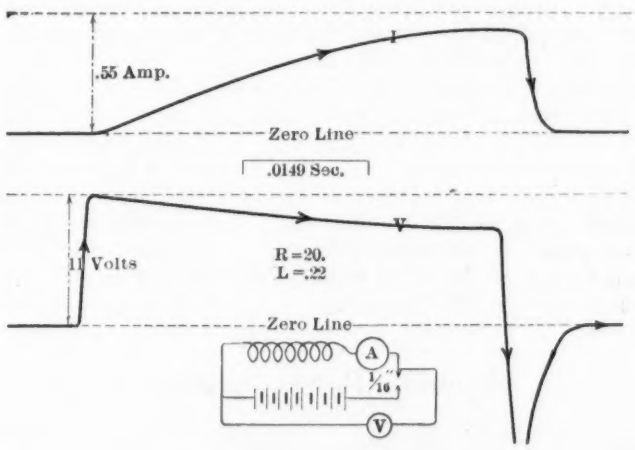


FIG. 8.—OSCILLOGRAPH RECORD.

The igniting arc does not, however, receive all of the magnetic energy, because of hysteresis and eddy-current losses in the iron core and the I^2R losses in the wire of the coil during the discharge. Moreover, the arc breaks before all the energy is discharged. These losses are, however, counterbalanced to some extent by the energy given to the coil by the battery after the arc is started, so that it may not be far wrong in discussing a touch-spark coil or similar coils used under constant conditions, to speak of the energy of the spark as being equal to the magnetic energy, *J*.

In discussing the efficiency of a touch spark coil, it will be best to consider the charge and discharge separately. The efficiency of the discharge will be large when the resistance of the arc is large as compared to the resistance of the coil, i. e., when the coil resistance is as near zero as possible and when the current is also small. The iron losses should also be small, and the arc should be of such a length that the maximum amount of energy may be discharged before the arc is blown out.

The efficiency of the charge will be large when a large amount of energy is stored in the magnetic circuit of the coil for the least battery expenditure. For example, if the current is cut off at *Z* and at *Z'* respectively (curve *B*) the core energy, *J*, will be practically the same, but the amount of battery expenditure will be much greater at *Z'*.

When the current is cut off at a low point on the curve, most

of the e.m.f. is expended in overcoming the c.e.m.f., or self-inductive pressure of the coil, i. e., in storing up magnetic energy; and only a small part of the battery pressure is used in overcoming the resistance of the battery and coil. This results in high efficiency as applied to the storage of magnetic energy.

Increasing the number of cells increases the resistance. If the resistance of the coil and connections is small as compared to that of the cells, so that the ratio of $\frac{E}{R}$ remains approximately constant, then, for any given value of L, R and t, the maximum value of the current would be the same, independently of the number of cells used, and the efficiency proportionately less the larger the number of cells.

In the construction of a touch-spark induction coil, the core should be made of soft iron wire, possessing high permeability and small hysteresis. The core should be annealed by heating it red hot in a piece of gas pipe and allowing it to cool very slowly. The wires should be small, the smaller the better, and shellacked or varnished before assembling to prevent any electrical contact among them. The length of the core may be from 4½ to 7 times the diameter. The diameter of the core, and to some extent the length of the core, would be determined by the kind of coil desired. A high resistance coil should have a short core of relatively large diameter and should be wound with a large number of turns of small wire. The wire should, however, be large enough so as not to overheat if the circuit is accidentally left closed. This construction would result in a very "fast" coil.

Conversely, a low resistance coil should have a long core of large diameter and a large ratio of length to core diameter, and the core should consist of a few turns of coarse wire, sufficient in number to give the desired self-induction.

It is very difficult to calculate the self-induction of a coil from its dimensions, so that with no experimental data, the only way is to construct a coil by trial and after measuring its resistance, and self-induction, modify the coil as follows: L varies as the square of the number of turns of wire and approximately as the number of iron wires in the core; and L increases with the length of the core. R varies approximately as the number of turns and inversely as the cross sectional area or size of the wire used.

London Power Scheme.

By James Lawrence.

References have been made from time to time in the columns of the Electrical World to the progress of power schemes in England. Though England has been somewhat behind the United States in the application of electricity as a motive power, signs are not wanting that she is endeavoring to make up for lost time. In particular with regard to London, many proposals have been made for the supply of power on a comprehensive scale. In 1904 a bill was promoted in Parliament with this object. This bill was discussed at great length by a select committee of the House of Commons, but was eventually abandoned, the abandonment being due in large measure to the hostility of a body known as the London County Council, who have powers within the administrative County of London. The real reason for this opposition was that the County Council desired to undertake the supply themselves. With this view they themselves promoted a bill in 1905, which was ultimately rejected by the House of Commons, a select committee of that body, however, making certain recommendations to the County Council for their guidance in preparing an alternative scheme. Proposals for an alternative scheme have recently been made by a committee of the Council and will be submitted to Parliament early next year. There are given below some of the more important recommendations of the committee. Those who are surprised at their complexity should understand that the supply of electricity in the English metropolis is at present in the hands of a large number of companies and local authorities, all of whom have vested interests which cannot be lightly disturbed or tampered with.

In rejecting the multifarious schemes which were submitted to Parliament last session for the supply of electricity in bulk to the metropolitan area, the select committee of the House of Commons which considered the bills, issued in effect an invitation to the London County Council to come back next session with an amended plan. A new scheme has now been drawn up by the Highways Committee of the Council, which will be submitted in due course to the County Council.

As the result of full consideration of the matter, the committee in its report, have come to the conclusion that the Council should introduce a bill into Parliament next session to authorize a comprehensive scheme for the supply of electrical energy for London and the adjacent districts. In preparing the scheme they have endeavored to fulfill the conditions of a satisfactory and adequate solution of the question as laid down in the select committee's report. The importance of electrical power as a means of developing and extending the commercial interests of London and the need of a cheap supply have long been recognized, and in previous reports they have laid stress upon the necessity of the Council being the central authority to secure such a supply. The main object which is aimed at is the establishment of an undertaking which will enable electricity to be supplied at cheap rates for all purposes, and which shall be adaptable to the growth of the area to be dealt with.

The central features of the scheme are as follows:

1. Area of supply to be 451 square miles (117 in London and 334 in the surrounding districts of Essex, Kent, Surrey and Middlesex).

2. Eventual purchase of the existing undertakings. Council to be compelled to supply.

3. Cost: Generating station, with land, £1,400,000; transmission and distribution system, £2,650,000.

4. Charges as low as compatible with financial success.

5. First two sections to be working by 1910.

The County Council committee observes that it is essential to the success of any scheme on the scale recommended by the Select Committee that arrangements should be made for so dealing with existing undertakings as not to prejudice the main project of the scheme which is to ensure a cheap supply of electricity for power and motive purposes. The Select Committee, while appearing to recognize that any comprehensive scheme must affect the position of existing undertakers, suggested that the interests of such undertakers should be upheld in a fair and reasonable manner. In framing their proposals they have kept this carefully in mind. It would not be satisfactory to establish a large generating station, and, at the same time, to maintain indefinitely the independent generating systems which now exist. To do so would be to increase very largely the cost of electricity to the consumer, owing to the duplication of plant, buildings, staff, etc., which would result, and the disjointed system of distribution which would be entailed. For this reason they consider that, as far as practicable, the scheme should provide for the eventual purchase on certain terms of the existing undertakings.

The capital invested in existing undertakings is:

Municipal	£ 5,450,000
Companies (within county area)	12,718,450
Total	£18,168,450

Exact figures are not available for the companies outside the county area which would be involved, but it is estimated that their capital does not far exceed a million. All the companies within the county are liable to purchase by the local authority before 1931.

American readers may not know that in England, the power to supply electricity whether for operating lamps or motors is only granted to a company subject to the risk of its being bought up by a local authority within a certain period.

The precise proposals as to purchase are, with regard to companies, that the Council should be empowered to exercise the local authorities' option at the time at which that option might in the ordinary course have been exercised. As for municipal undertakings electric lighting orders have been granted to sixteen local authorities in London. All of these authorities, with

one exception, are now supplying electricity. Three of them are authorized to supply in bulk, but no supply is being given by any of them. It is suggested that the Council should be empowered to acquire compulsorily at the expiration of five years from the passing of the bill, or at any time thereafter by giving one year's notice, the undertakings of the undermentioned authorities in London—viz., the undertakings of the borough councils of Battersea, Bermondsey, Bethnal Green, Fulham, Hackney, Hammersmith, Hampstead, Islington, Poplar, St. Pancras, Shoreditch, Southwark, Stepney and Stoke Newington. These are the undertakings which were originally established under provisional orders obtained by the local authorities from the Board of Trade. The borough councils of St. Marylebone and Woolwich are not included in the foregoing list, their undertakings having in part been purchased from companies. In proposing the term of five years regard is had to the time which will be occupied in developing the sources of supply of electrical energy proposed under this scheme, and the acquisition of the undertakings of the local authorities at the end of that period would assure the Council a regular demand for power from the districts now served by these authorities.

It is also proposed to enable the Council to purchase at any time by agreement the whole or any part of the undertaking of any of the local authorities within the county, and that powers should also be taken for the Council to enter into agreements with local authorities with regard to the Council's undertaking, so that if it may hereafter so decide, the Council may be able to arrange for the whole or any portion of the work of distribution of electricity being carried out by the local authorities. As regards the undertakings of local authorities outside the County of London, a different state of affairs obtains. It would, however, be useful for the Council to obtain powers to purchase the whole or part of any such undertaking by agreement, and it is proposed to insert a clause to this effect, as well as a clause to enable the Council to enter into agreements with such authorities for them subsequently to undertake the whole or any portion of the work of distribution in their districts.

With regard to generating stations it is proposed that those required for the scheme should be erected on one of the two alternative sites. One of these is situated at Barking and the other at Erith. These sites have been selected after very careful consideration of the needs as a whole of the area to be dealt with, and by adopting one of them great economy in the transmission of energy will be secured. The proposed generating station would be erected in sections which could be proceeded with as the demand requires. The site acquired will be large enough to enable the station to be subsequently increased to a very large capacity to meet the anticipated increase in the demand for power resulting from a cheap supply.

The fact that the committee of the House of Commons thinks that the County Council should be under compulsion to supply electricity will necessitate provision being made for a supply adequate to the probable demand from existing undertakers as well as to meet the requirements of large individual consumers such as railways, tramways, docks, water works, etc., to which the Council should have power to supply direct. In addition to giving a supply untransformed at high pressure, the committee thinks that the Council should also give the supply at the pressure and of the kind which may reasonably be required by the various classes of consumers, and provide the necessary transforming apparatus.

As regards the switch centers, it is proposed in a number of cases to utilize the existing tramway sub-stations, and this will enable considerable economy to be effected. In other cases either fresh sites will have to be obtained or the stations of existing undertakers will be used.

It is proposed to make provision for the purchase of motors and other apparatus for hire to power consumers, a matter of considerable importance in securing the extended use of electricity for manufacturing purposes. The capital expenditure thus involved, which is included in the sum of £2,650,000 mentioned, will be covered by the rent which it is intended should be charged for the use of the plant. Specific powers are to be included in the bill to enable the Council to supply this apparatus. And the Committee also consider it advisable to confer similar powers upon all authorized distributors who are local authorities within the area of supply.

The bill is to provide for the maximum charges for energy being governed by the amount and regularity of the demand of the consumer, different charges being made according to whether the current required is high or low tension, alternating or direct, the times at which it is used, etc., and that the charges shall be as low as is compatible with the financial success of the undertaking. In this connection regard will be had to the necessity for building up an adequate reserve fund to meet all possible contingencies, and generally to the importance of ensuring that the undertaking shall be placed upon a sound financial footing. The scheme of supply provides for the first two sections of the generating station to be completed and working by 1910, and by that time it is anticipated that the demand for power will be such as to employ fully this part of the station, and to enable energy to be supplied at a low rate.

As regards the financial results of the undertaking, the prospective demand for electricity is so great that the revenue derived from the undertaking will be more than sufficient to cover the expenditure, including the charges for sinking fund and interest on capital. It must be borne in mind that the capital expenditure will be gradual, as the scheme contemplates that the new bulk supply station shall be built in sections to meet the increasing demand as it arises, and the scheme accordingly provides for the expenditure to be spread over a period of seven years. The committee conclude their report as follows:

"It is of the utmost importance to London and the surrounding communities that a cheap supply of electricity should be available for manufacturing purposes, and we are strongly of opinion that there should be no delay in placing its manufacture and distribution on a sound and economical footing. Within the proposed area of supply the volume of manufactures is greater than in any other manufacturing district in the United Kingdom, and a vast and increasing population is engaged in its industries. The unanimous findings of the Select Committee specially appointed to inquire into the subject show conclusively the necessity for immediate action, and we have therefore no hesitation in recommending the promotion of legislation next session on the lines indicated."

Oscillographs and Some of Their Recent Applications.

BY DAVID A. RAMSAY.

THE recent developments in the use of alternating currents, and especially of high-tension and extra high-tension currents for the transmission of power over long distances, has rendered necessary a study of the phenomena which occur in such cases.

Many of the methods which are applicable in the case of continuous currents, and have rendered measurements in connection with them capable of such a high degree of precision, fail completely when alternating-current measurements are in question. It is also true that many factors such as capacity and inductance, which are of small importance in the case of continuous currents, are of the greatest importance in dealing with alternating or rapidly fluctuating currents.

It is the purpose of the following notes to point out several such problems which the Duddell oscillograph is particularly well adapted to investigate, and to give one or two examples of some results that have been obtained. This instrument is manufactured by the Cambridge Scientific Instrument Company, Cambridge, England, in various forms with a very complete range of accessories, and an attempt will be made to show the form of instrument best suited to the several different classes of research or demonstration in which it may be profitably employed.

An oscillograph may be described as a moving coil galvanometer of very short period, the deflection of which at any instant is practically proportional to the current flowing through it at that instant, in spite of the fact that the current may be varying very rapidly in strength and in direction. It must be critically damped, as any tendency to overshoot would distort the record of the wave form from its true shape.

The original idea of the instrument is due to M. Blondel, who pointed out in 1893 the principles on which such an instrument should be designed, but to Mr. Duddell is due the credit of developing the instrument into its present form as a practical commercial instrument.

The moving or vibrating part of the instrument consists practically of a single pair of fine phosphor-bronze strips kept under considerable tension in a strong magnetic field. Across these strips a very small and light mirror is fixed. A beam of light from an arc lamp, or other source of intense light, is thrown on to this mirror and reflected from it on to a suitable screen. Thus when a current is sent through the strips the deflection of the mirror causes the spot of light reflected from it to move; the displacement from the zero position being a measure of the current. If the screen is also moved in a direction at right angles to the motion of the reflected spot of light, a curve is traced out by the spot of light which shows the true value of the current at any instant. In this way the e.m.f. and current curves of an alternating supply are obtained.

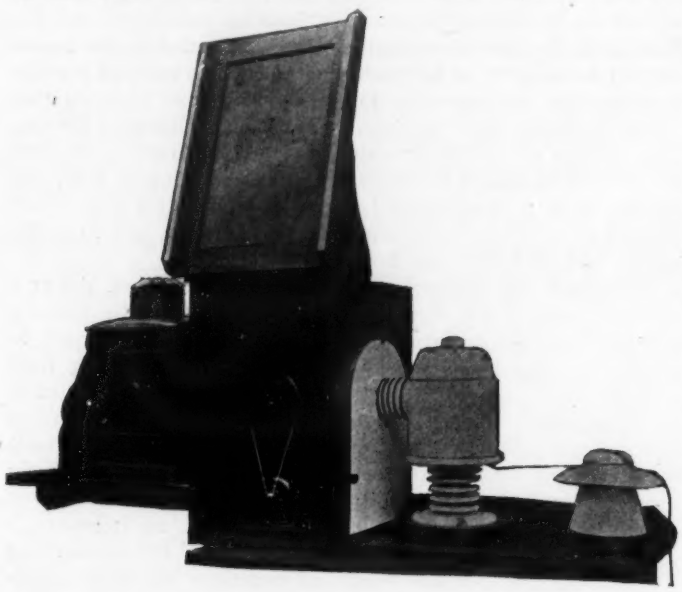


FIG. 1.—GENERAL VIEW OF OSCILLOGRAPH.

In all large schemes where power is distributed over a considerable area one of the largest items in the capital cost, as well as in the cost of up-keep, is the distributing cables. A knowledge, therefore, of the strains to which the insulation of the cables may be subjected is of great importance. This information is most readily obtained by studying the shape of the e.m.f. wave by means of the oscillograph. It will be obvious, that it is only when the actual shape of the wave-form is known, that the relation between the effective value of the voltage and the maximum value (which is the important point in so far as the insulation of the cables is concerned) can be found. This is important on high-tension systems, and it is equally important that the experiments should be carried out on the primary or high-tension circuit. Transformers frequently alter the shape of the wave and fail altogether to reproduce higher harmonics which may be of great importance.

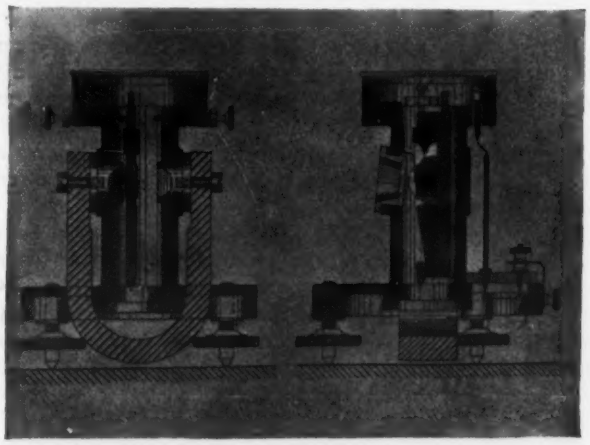
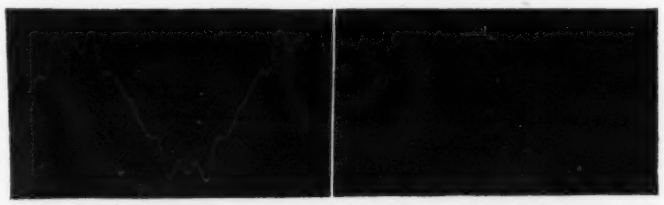


FIG. 2.—DETAILS OF OSCILLOGRAPH.

With this point in view a special oscillograph set has been designed for use on high-tension circuits, a view of which is given in Fig. 1. In this oscillograph the magnetic field is produced by means of a strong permanent magnet so that the only connections to the oscillograph are those from the vibrating systems to the circuit to be investigated. It is thus easy to effectively insulate the instrument.

In the outfit illustrated this insulation is provided by placing the oscillograph on a tall corrugated porcelain insulator. It has also a porcelain cover, while the possibility of brush discharge to the case is further provided against by having a large porcelain plate between the instrument and the case. Behind the oscillograph there is a large high-tension insulator for the purpose of supporting the leads to the oscillograph. With this outfit circuits of high potential up to 30,000 volts may be safely studied. Fig. 1 shows the instrument with cover on ready for work. As the oscillograph itself presents some new features it is shown more in detail in Fig. 2. All the working parts are enclosed in a strong metal case which has iron pole-pieces let into the sides to concentrate the magnetic field. This case is filled with the damping oil and is provided with an oil-tight lid. The two vibrating systems are also quite distinct from each other and can be removed independently for repair. One of these with one side removed is shown in the figure. As each vibrating system is made as simple as possible no special skill is required to repair it, any reasonably skilled experimenter being able to re-suspend it complete in about a couple of hours. Anyone, who has endeavored to re-suspend vibrators of the double high-frequency type, will realize what a great improvement Mr. Duddell has introduced in this new simple vibrator.

By means of a screw the spots may be adjusted in azimuth,



FIGS. 3 AND 4.—E.M.F. WAVES AT GENERATOR AND AT CABLES.

and by a second adjustment the whole vibrator can be tilted through a small angle so as to bring the spots into the same horizontal plane.

When such high tensions as those mentioned above are used it is, of course, necessary to provide a large non-inductive resistance to put in series with one pair of strips to obtain the e.m.f. wave. For this a special type of resistance patented by Messrs. Duddell and Mather is made. This consists of fine silk-covered wire woven with silk in the form of cloth and immersed in insulating oil; thus providing a large resistance in a compact form and free from inductive or capacity effects. To obtain instantaneous photographic records such as the wave form of an alternator with this apparatus a photographic plate, allowed to fall down a slide under the action of gravity, is employed, the height through which the plate falls being suitably adjusted to the frequency. The instrument is also provided with a set of revolving mirrors driven by a small motor (see Fig. 1) in which the curves may be visually examined, even while the photograph is being taken.

As an example of the practical value of such a study of the wave-form the following actual case is of interest. An investigation by means of the oscillograph being made on the alternators of a well-known supply company, revealed the fact that one of the 5,000-volt generators had rather an abnormal wave-form which is shown in Fig. 3. When connected to lightly loaded cables the irregularities were greatly magnified by the capacity of the cables, and the result was the curve of Fig. 4, which shows that the strain on the insulation of the cables was increased.

As a result of this investigation the pole-pieces of the generator

were re-designed, and the wave-form made almost completely sinusoidal.

In some cases, however, such as at the moment of switching on or off a high-tension cable, quite abnormal conditions are produced, which it may be even more important to study than the shape of the waves under ordinary conditions. For this purpose a simple form of cinematograph film camera is provided.

The case of the falling plate instrument is provided with an

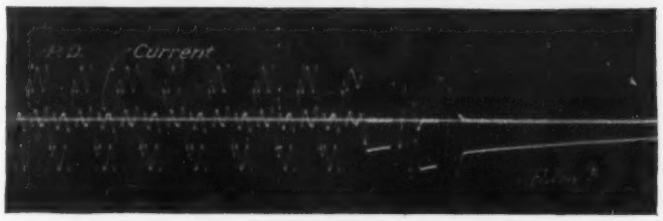


FIG. 5.—POTENTIAL RISE ON DISCONNECTING A HIGH POTENTIAL FEEDER.

aperture into which the cinematograph camera slides up to a shoulder and in this position the plane of the film occupies the position previously occupied by the falling plate. The latter can thus be replaced by the film camera very quickly without interfering with any other of the instrument adjustments. The camera can be used with films or negative paper, the latter rendering the photographs comparatively inexpensive. With it any

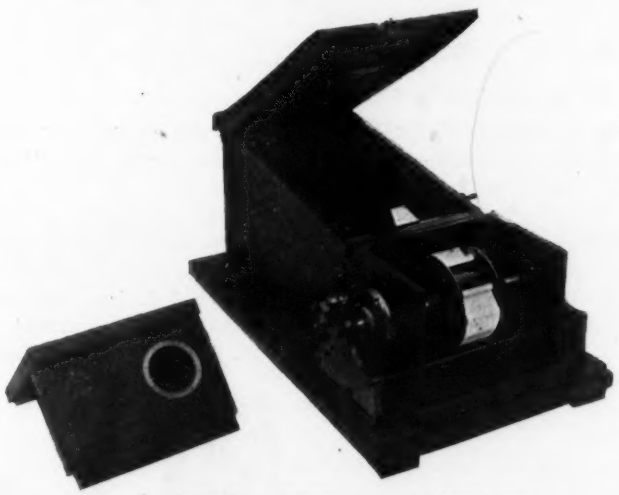
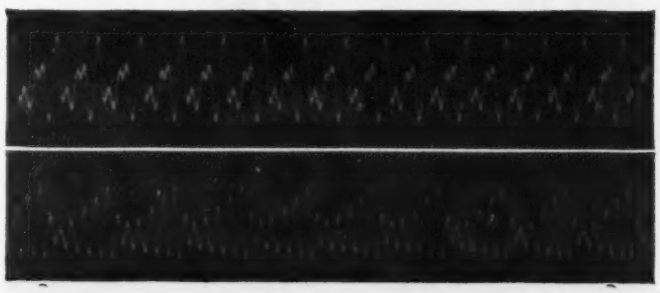


FIG. 6.—REVOLVING DRUM FOR OSCILLOGRAPH.

length of film up to 200 ft. may be exposed, thus enabling transitory phenomena such as that mentioned above, to be investigated. As an example of a record of this kind, Fig. 5 is interesting, as showing the great rise of potential on switching off a high-tension feeder. This arrangement is also particularly suitable for the study of the important question of the performance of air-



FIGS. 7 AND 8.—OSCILLOGRAMS OF TELEPHONE CURRENTS.

break and oil-break switches. By this means Mr. Duddell has shown that switching off the same cable as in Fig. 5 under the same conditions, with the exception that the contacts were under oil, no rise of potential at all was obtained, thus proving in this case the great superiority of oil-break switches.

Another direction in which the oscillograph has lately been successfully employed is in connection with telephonic research. In this case the pattern usually employed is what is called the high-frequency type. In this instrument, the vibrating system of which is now completely immersed in oil, the free period of the vibrating system is only 1/10,000 of a second and it is rendered accurately dead-beat by means of the damping oil so that it is well adapted for investigating the very rapid fluctuations of

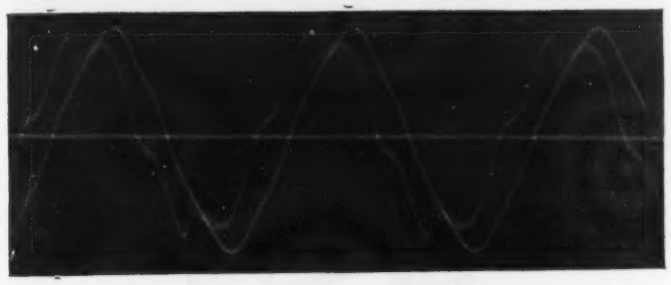


FIG. 9.—OSCILLOGRAM OF CURRENT AND E.M.F. IN ELECTROLYSIS.

the current caused by speaking into a telephone. The recording apparatus usually consists of a falling plate or a revolving drum photographic camera. For such records the falling plate camera is usually fitted with a special slow speed slide in which the speed with which the plate falls can be varied within wide limits by means of a counterpoise. The revolving drum outfit is shown in Fig. 6. With it any length up to 40 cms. of film of standard width (8 cms. or 3¼ in.) can be exposed. It is also fitted with an automatic shutter which is allowed to open during one revolution of the drum only, or during a fraction of a revolution if it is required to expose less than 40 cm. of film. As an example of the performance of this type of instrument Figs. 7 and 8 are of interest. In each case the time scale is 250 cms. per second. Fig. 7 shows the current produced in a telephone on making the vowel sound of long "a" as in Ma. Fig. 8 is the sound of "o" as in No.

Among the many other uses to which the high frequency type of oscillograph has been put one or two will be briefly referred to. One is that of investigating the characteristic curves of medical induction coils. By its means Drs. Head and Lewis Jones have shown that the duration of the wave is the chief factor in determining the painful or painless character of the current, and that the presence of iron in the coil produces a marked effect in increasing the length of time which these momentary currents last.

This type of oscillograph has also been successfully employed by Mr. W .R. Cooper to investigate the phenomena occurring during electrolysis by alternating current. In a paper read before the Faraday Society on October 31, 1905, he showed a number of extremely interesting curves indicating what happens under varying conditions as to applied e.m.f. and current density. He has kindly permitted the writer to reproduce one of these, which is shown in Fig. 9. This shows the e.m.f. and current during the electrolysis of a dilute solution of sulphuric acid of specific gravity, 1.130, when the applied e.m.f. is 1.8 volts the electrodes being platinum wires 0.18 mm. diameter and 2 cms. long. The extremely rapid oscillations shown are probably due to the smallness of the electrodes.

New Telephone Patents.

SELECTIVE CALLING SYSTEM.

Some time ago there appeared patents for a selective ringing system which was peculiar because of a feature which may be termed negative selection. By this is meant a system wherein the signal-controlling devices operate at all except the desired station, at which station the control remains neutral or normal. In the earlier patents the system was based upon a potentiometer effect, the apparatus of each station being adjusted to balanced potentials. In a new system recently patented by the same inventor, S. A. Reed, of New York City, the system is changed to a straight differential one, which permits of the use of a wider range of adjustment and heavier apparatus. The true underlying principle is the same as in the earlier system, wherein the cur-

rents approaching each station from the two limbs of the line balance in effect in the windings of the desired station, but are out of balance at all other stations.

INTERCOMMUNICATION SWITCH.

An intercommunicating system dial switch forms the subject of a patent issued to Lambert Schmidt, of Weehawken, N. J.

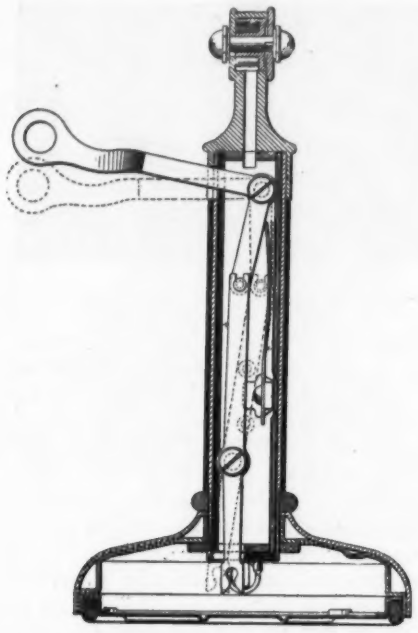


FIG. 1.—MANSON TELEPHONE DESK STAND.

The knob for rotating the dial pointer and trailer is arranged to be depressed. It is held up by the trailer, which is in the form of a bowed flat spring. One end travels the contacts and the other end travels just short of the ringing bus. When the knob is depressed the flattening of the bow drives its end upon the ringing bus, to cause the signals.

STEP-BY-STEP PARTY SYSTEMS.

Not only with automatics, but also with lock-out step-by-step systems the failure to restore after use stops all operations. C. A. Anderson has, therefore, arranged a special circuit and apparatus for the central so that the act of disconnecting from the jack of such a line automatically restores the instruments.

M. W. Phillips, of Ventura, Cal., has patented a lock-out system in which two relays control. One operates on limits, i. e., will only operate so long as no other apparatus is across the circuit. Thus, the relay at the first station connects a shunt across the line which remains during that connection, no other station can operate its relay to come in. Another somewhat similar system has been invented by W. M. Bruce, of Springfield, Ohio. This also requires two relays.

SUBSCRIBERS' SETS.

R. D. Manson, of Elyria, Ohio, has invented the desk stand shown in section in Fig. 1, his patent being assigned to the Dean Electric Company. The novelty in this stand lies in the fact that all the switch springs are in the base, the upright containing a linkage only for transferring motion from the hook lever to the wedge. The action is clear from the cut. Another set by the same inventor and similarly assigned is an all-metal wall set with a casing of pressed sheet steel. The novelty lies in the details of construction.

For hand microphone sets there is at times a tendency for the receiver on one end of the handle to affect the transmitter at the other by mechanical vibration, with the result that there is a tendency for the instrument to sing exactly as when a receiver of any working set is opposed to the transmitter mouthpiece by mutual reaction. C. C. Gilchrest, of New York City, has arranged to overcome this by perforating the hollow handle at each end with a ring of small holes to break up vibrations of the contained air column. Mr. Gilchrest has assigned his patent to the Western Electric Company.

CENTRAL ENERGY SWITCHBOARD CIRCUITS.

Rather a novelty in two-wire switchboard circuit systems is one patented by W. W. Dean and assigned to the Kellogg Company, in which all the relays are polarized and the control of the various signals depends upon the direction of the current flow. The battery is split and so connected that before a plug is inserted in a jack, the line relay is in the return to one battery section,

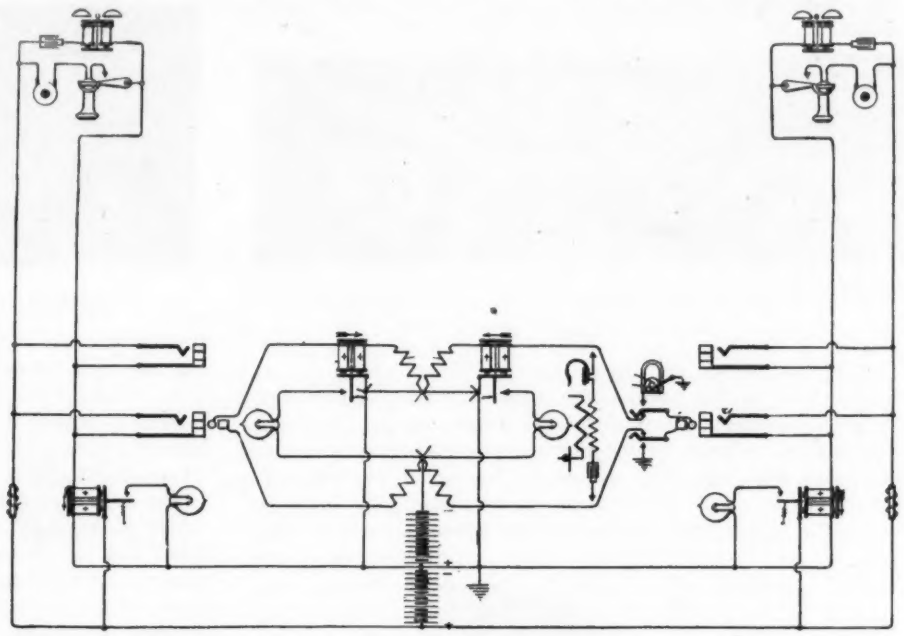


FIG. 2.—DEAN TELEPHONE SYSTEM.

while the insertion of the plug transfers this to the feed from the other battery section. This may be traced out in Fig. 2, which shows the circuit.

IMPROVED APPARATUS.

Because transmitters and receivers of the same circuit included in a single casing tend to sing, combined instruments have been heretofore quite unsuccessful. Various special devices have been produced to overcome this mutual reaction. One invented by C. E. Ljungman, R. O. Percival and W. A. Hjorth, all of Stock-

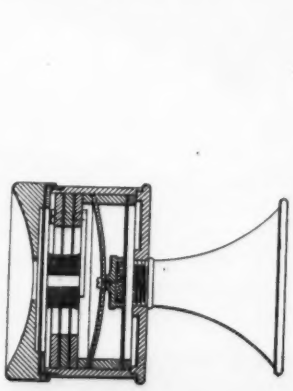


FIG. 3.—COMBINED RECEIVER AND MICROPHONE.

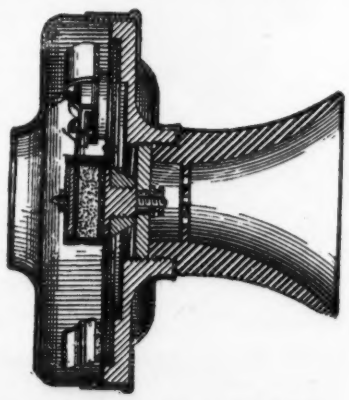


FIG. 4.—ALBRIGHT TRANSMITTER.

holm, Sweden, is shown in Fig. 3. The arched diaphragm constitutes the invention, this failing to transmit the receiver vibrations to the transmitter.

In Fig. 4 is shown a novel inverted solid-back type of transmitter, in which the bridge is formed in the sound channel. This bridge consists of a washer with a cross bar, the washer being secured in the opening at the base of the mouthpiece. The microphone button casing is carried by the diaphragm, while the front electrode is clamped to the cross bar of the bridge or washer. This transmitter is the invention of H. F. Albright, of New York, his patent being assigned to the Western Electric Company.

With intersignaling party line stations it is often desirable for the central to hear each code signal rung that she will not interfere unnecessarily. To assist in this C. A. England, of Van Meter, Iowa, has invented a contact attachment for line drops for such

lines. The contact is closed each time the drop armature is pulled up. This contact controls a bell and thus the operator gets the code ring.

H. T. Albright, of New York, has patented a receiver using an ironclad magnet. The tubular magnet carries an internal core over the end of which the coil is slipped. The cup for holding the diaphragm is of metal and is secured to the tubular magnet. The rubber ear piece clamps the diaphragm in the usual manner. A rear cap screws on to cover the terminals. The Western Electric Company has been assigned this patent.

F. R. McBerty, of Evanston, Ill., has also patented a two-wire circuit system, his patent being assigned to the Western Electric Company. This system is for a divided multiple switchboard, with a selection of line signals by the subscriber in accordance with which of the switchboards the desired number is multipled. Keys are provided at the subscriber's station, one to ground each side of the line, thereby affecting a line relay in the corresponding side of the line. The line lamp circuits controlled by these relays are fed through a common resistance, and either lamp will glow with the other open. With both closed, however, each shunts the other and neither lights, because of the resistance in series.

Another patent assigned to this company covers a new spring jack, the invention of H. B. Holmes, of Park Ridge, Ill., and E. B. Craft, of Chicago. The novelty lies in the mechanical details. The jack springs are assembled in units upon metallic frames, while the thimbles are mounted in face strips carried on metal plates. The spring units have an insulated eye through which the thimble terminal may be threaded when a spring unit is to be mounted on the plate. The advantage lies in the fact that the springs may be made up independently of the number of jacks in the strip with which they may be eventually used.

A new clamp for attaching a branch line to a line wire has been patented by C. L. Pierce, Jr., of Chicago, the patent being assigned to the Pierce Specialty Company. A slip of sheet metal has its ends crimped and is then bent double so that the crimp comes together to form a tubular opening. A flat slip of metal is placed between the legs of the bent piece and a screw is then passed through the whole. The middle slip has the bottom pointed and this point lies in a small perforation in the bottom of the bent piece. This prevents it from twisting around. The wires to be connected are placed in the grooves, one on each side of the middle partition and the screw is tightened.

LETTERS TO THE EDITOR.

Thermo-Electric Wave Detectors.

To the Editors of Electrical World:

SIRS:—The communication of Prof. Fessenden in your issue of November 10 is of interest to me, as an early investigator of thermo-electric wave detectors. Early in 1902 I observed that certain of the so-called "self-restoring coherers," notably the carbon-steel microphone, were operative without local battery. The necessary condition of this operation seemed to be a good electrical contact between the elements, as distinguished from the light, or coherer type of contact.

In the fall of 1902, while investigating various detectors in connection with Hertzian wave wireless telephony, I examined more in detail the action of thermo-electric detectors. In the course of this investigation, it appeared that almost any junction of dissimilar conductors would make an operative wave detector, if certain conditions of contact area and pressure were complied with. It also appeared that for the best results at least one of the elements should be of high electrical resistance, as, for example, a thin oxide layer on a metal, a carbon surface, or a film of selenium.

While in my early experiments a considerable degree of sensitiveness was obtained, it was found difficult to secure a loud response, or to prevent a "fatigue" effect, which after a varying, although usually all too short time, rendered the junction to all intents and purposes inoperative. A microscopical examination of the contact surfaces seemed to show that this "fatigue" was really due to a disintegration, or physical change in the surfaces.

In the endeavor to make the thermo-electric action constant, I later investigated at some length the electric furnace products, which from their hardness, high specific resistance and relative infusibility, seemed suitable for a constant thermo-junction of small area. After trial of a large number of elements and compounds, pure silicon was found to possess high thermo-electromotive force against any metal contact, a relatively high and constant contact resistance, and great stability. A thermo-electric detector, formed of a silicon surface and a small metal point pressed in good contact therewith, compared favorably with either electrolytic or magnetic detectors in sensitiveness and stability.

It is probable, as Prof. Fessenden remarks, that the degree of pressure required at such a contact accounts for the fact that most investigators have entirely missed the effect.

AMESBURY, MASS. GREENLEAF W. PICKARD.

Polyphase Magnets.

To the Editors of The Electrical World:

SIRS:—Referring to Mr. Lindquist's reply to my criticism in your issue of October 27, it appears to me that he does not quite hit the real point in question, and as long as he cannot agree with me that any secondary winding on a transformer, or magnet, must consume useful energy, it does not seem worth while to go further into details. I am willing, however, to modify this statement, if in the meantime Mr. Lindquist has found the ideal conductor which has no ohmic resistance and which, therefore, conducts electric current without ohmic drop.

MILWAUKEE, WIS. ARTHUR SIMON.

[Mr. Simon's letter of criticism in our issue for October 20 does not imply that Mr. Lindquist has denied that the "secondary winding of a transformer or magnet must consume useful energy." On the contrary, Mr. Lindquist is quoted as follows: "Increased losses are due partly to induced currents in the surrounding brass parts." There can be no doubt that if the brass parts were placed perpendicular to the useful flux, the original criticism of Mr. Simon would hold; but since the parts are applied parallel to the flux, and in such a way that they tend to concentrate and force it to follow the desired path, the several explanations offered by Mr. Lindquist appear to be strictly in accord with facts.—EDS.]

Standardization of Direct-Current Traction Motors.

To the Editors of Electrical World:

SIRS:—In your issue of October 13, page 699, you publish a criticism, and on page 714 a translation of the standardization report of the Milan International Congress of Local Tramways and Railways. As I was the editor of the text in the original and also had the honor of bringing this text before the Congress at Milan, you will perhaps allow me to make some remarks about your translation and the criticism based thereon. I do this not in a cavilling spirit, but merely to prevent misunderstanding. Your criticism fits your translation, but your translation does not fit the original text. I give a few instances: You say that the power is defined as given off on the spindle (shaft) of the motor itself, and this is also so stated in your translation; but in the original it is clearly stated that under the "term power is to be understood that power which is given off on the axle of the car." The matter is made still more clear by a foot note, where as an exception, but to be clearly specified, the term may be applied to the power given off by the motor spindle. Curiously enough, you also give this foot note. With regard to efficiency you fall into the same error. We define it as the ratio of output on the car axle to input on the motor terminals. You substitute motor axle for car axle. As regards your strictures on the definition of speed, this also applies only to your translation, but not to our original. In your translation you say "speed of the motor," but

we do not mention the word motor at all. We simply say: "Under the term speed is to be understood the speed of the circumference of the running wheels." Similarly we define the tractive force as the force exerted at the circumference of a wheel equal in diameter to the running wheels.

I may say that the leading idea in these rules was to treat the motor with its gear as one unit and not the motor alone and the gear alone or not at all. Practical tramway men do not care what the torque, angular velocity or efficiency of the motor is. They want to know what the motor will do when fitted in the car. They want to know the tractive force on the rails, the speed in miles per hour and the efficiency from trolley to car axle.

There are some omissions and minor defects in your translation, but as I have already occupied a good deal of your valuable space I shall not go further into details. I venture, however, to suggest that it would be appreciated by many of your readers and would be fair to the committee if you would publish a correct translation of these rules.

Birmingham, England. Gisbert Kapp.

[We desire to offer our earnest apologies for any oversights in our published translation of the Milan Congress proposed rules. We think, however, on comparing the original French text with our translation and the author's rendering presented in the above letter, that there is room for considerable ambiguity in the text, and that the vital distinction between a motor axle and a car axle should not be left to a foot note, which refers only to a single clause. We also maintain our opinion that the speed of a motor ("La vitesse d'un moteur") should be an angular velocity and not a peripheral velocity, whether the motor is geared to a car axle or not; and we cannot change our view that the Milan Congress was not sufficiently representative, politically or professionally, to deal with international standardization.—Eds.]

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Output Coefficients.—Hobart and Ellis.—The first part of an article on the output coefficient of electrical machinery, which is defined as the ratio of the watts rated output to the product of the square of the air-gap diameter of the armature in centimeters by the gross core length of the armature in centimeters by the speed in revolutions per minute. While accumulated experience in designing and manufacturing tends to increase the practical output coefficients, the highly commendable tendency toward greater stringency in modern specifications tends to counteract, or, at any rate, retard the progress toward higher output coefficients. Numerical data are collected about the output coefficients of actually built machines representing especially European practices. —Lond. *Elec. Rev.*, November 2.

Alternators.—Lincoln.—A second article on the construction, performance and operation of alternating-current generators. In the present installment the author describes the construction of the collector rings, air-gap, slots and teeth, the securing of electric balance, the provision of proper ventilation, and different types of windings. He then passes over to the discussion of performance of alternators and first deals with their regulation.—*Elec. Jour.*, November.

Lamps and Lighting

Absorption of Light by the Atmosphere.—Dow.—The author discusses the absorption by the atmosphere of light of different wave lengths and shows that luminous rays of great wave length at the red end of the spectrum penetrate the atmosphere with greater ease than luminous violet light of short wave length.—Lond. *Elec. Rev.*, November 2.

Train Lighting.—An account of tests of the Leitner-Lucas train lighting system, the results being given in tables and diagrams.—Lond. *Elec. Rev.*, November 2.

Collection of Incandescent Lamps.—A report of the committee of the Franklin Institute, recommending the award of the Elliott Cresson medal to W. J. Hammer for his historical collection of incandescent electric lamps.—*Jour. Franklin Inst.*, November.

Power.

Induction Motors.—Reed.—A discussion of the operating characteristic features of polyphase induction motors. They are classed as constant-speed and variable-speed motors, and especial attention is called to the speed torque curve, the maximum starting torque and current, the rating, the efficiency and power factor under different conditions. The variable-speed motor should be used when frequent severe starts are necessary and the period of operation is short, and where variations in torque and speed are great—for example, on cranes, elevators, hoists, railways, roller beds, bending rolls, reciprocating machine tools, punches, shears, etc. For elevator or similar work where quick, frequent starts and stops are necessary, motors having a minimum inertia of rotating parts should be used. In this case it is advisable to use motors of the slowest speed and lightest weight of rotor that will give satisfactory operation. Constant-speed motors are generally used for that class of service which requires fairly constant power for a long period, good speed regulation, infrequent starting and only average starting torque, such as driving line shafting, high and low-speed centrifugal and reciprocating pumps, air compressors, blowers, fans, rotary motion machine tools, wood-working machinery, lathes, boring mills, circular and hand saws, motor-generator sets, frequency changers, continuous-running, constant-loaded machinery, etc. In general the short-circuited type of rotor should be used when the motor is small compared with the size of the generating station; when the voltage regulation of the system would not be affected by the starting current required by large motors; when the starting conditions are not frequent or severe; when the motor is not accessible for frequent inspection and where simplicity is of great importance. The wound rotor should be used when the motor is large compared with the capacity of the generating station; when good voltage regulation is necessary; when frequent starting is required and where large starting current would seriously affect, or be undesirable to the system; for work at reduced speeds or where fairly heavy loads must be brought up to speed gradually. In an editorial note by Miller it is pointed out that to get the best results from electric driving, it is necessary to see in the selection of induction motors that each motor is exactly adapted to the conditions to be met, in its type and size, and starting appliances. —*Elec. Jour.*, November.

Electric Lighting by Wind Power.—Burne.—A full discussion of the possibility of utilizing the wind as a motive power for electric lighting installations. The limits of useful wind velocity for power purposes are taken as from 10 up to about 20 or at most 25 miles, per hour. With respect to the wind motor itself, there is a choice between the old-fashioned windmill with four sweeps, and the modern annular disc sail wheel. The disc mill has some advantages which enable it to supersede its older competitor for motors of moderate size, but as constructional considerations impose a limit to the sail area exposed, the four-armed mill, owing to its far higher efficiency per unit of surface, will probably still hold its own when a motor of large size is required. At present disc mills appear not to be made of a diameter greater than 40 ft. The construction of each type is discussed. For a four-armed mill the work amounts in a 12-mile wind, to 6.16 ft.-pounds per second per square foot of sail surface. For a mill 16 ft. in diameter, the maximum sail area is 51.2 sq. ft., so that the horse-power works out to 0.573. In view of the incessantly varying force of the wind, the adoption of some regulating device is required, and the problems involved are quite similar to those of train lighting. Some details are given on an installation at Askov. The wind mill, which was erected in 1897, has four sweeps, the span of which is 75 ft. and the breadth 8½ ft. It is provided with automatic self-winding gear similar to that of an ordinary tower mill. Two dynamos are in use, one giving 250 amp. at 28 volts for water electrolysis and the other giving 40 amp. at 150 volts for charging a 60-cell battery with a capacity of 390 amp.-hours. There are now connected 450 incandescent lamps, besides a few arc lamps and motors. A petrol motor has

also been added as an auxiliary since it was found that its cost is less than that of the extra storage that would otherwise be necessary. The first cost of the installation was $4,365, while the working cost per year is $166. The receipts for electrical energy amount to $700, giving an excess of receipts over expenditures of about 12 per cent on the capital outlay.—Lond. *Elec. Rev.*, October 19.

Power Transmission.—WILDA.—An article in which the author discusses the various factors which enter into the discussion of electric power transmission. A numerical example is given on the transmission of a maximum of 10,000 hp from a water power plant to a city 96 or 144 miles distant, at a voltage of 40,000 or 60,000. The results are given in the following table:

Transmission line in miles	96	144	144
Transmission voltage	40,000	40,000	60,000
Generation of 1 hp-hour.....cents	0.53	0.53	0.53
Transmission of 1 hp-hour .....cents	0.42	0.55	0.44
Total cost of 1 hp-hour .....cents	0.95	1.08	0.97
Generation of 1 hp-year of 3,000 hours	$15.90	$15.90	$15.90
Transmission of 1 hp-year of 3,000 hours....	12.60	16.65	13.28
Total cost of 1 hp-year of 3,000 hours.....	28.50	32.55	29.18

The figures relate, of course, to Continental European conditions.—*Elek. u. Polyt. Rundschau*, October 31.

Traction.

Overhead Equipment for Tramways.—CAMPION.—An abstract of a paper read before the Leeds Section of the British Inst. Elec. Eng. He discussed the relative advantages of span-wire suspension and bracket arm suspension from side and center poles. In speaking of negative return feeders, the author remarked that on a line with which he is connected the return feeders are taken from the rails where two spurs branch off from the main line, this position being 1,200 yards away from the generating station, and the earth plates are also sunk at this point. These two cables are 6 sq. in. each, and on testing the negative bus-bar to earth with a load of 600 amp. they had obtained 25 volts, with a leakage current of 35 amp.; the bonding of the rails was then examined with a millivoltmeter and no fault was apparent there. The conductors were then tested out and a saddle put across and bonded to all four rails just outside the generating station, and this leakage has been considerably reduced. He then gave some notes on automatic point controllers and figures for cost of maintenance of overhead lines per mile at different places. He then compared the relative advantages of fixed and swivel trolley heads in favor of the former. He considered that a fixed head with trolley arms adjusted to 23 lb. tension and a current density not exceeding 50 amp. per sq. in. is the best practice in England up to the present time. With regard to the bow collector, the following are given as its chief advantages over the wheel collector: Less wear on the overhead line when rounding curves; less noise in action than the trolley; entire construction of the overhead line can be simplified, especially at curves and turnouts; the ears and frogs can be more substantially designed; no possibility of the collector "jumping" the overhead line; can run in either direction, obviating the necessity of reversing the collector at a terminus.—Lond. *Elec.*, November 2.

Tramway Brakes.—SAYERS.—The concluding part of his article. In this installment he speaks of track brakes and describes a combined magnetic track and wheel brake. As general conclusions he sums up what he considers good practice at present. On level lines, with rails generally clean, low maximum speeds, few stops and little other traffic, hand brakes and the rheostatic brake will answer the requirements. The rheostatic brake should be used for some service stops on every trip. On hilly lines wooden-blocked, manually-applied track brakes are required in addition to the wheel brakes. The rheostatic brake is a desirable addition. The combination of high overall speeds, frequent service and heavy general traffic call for the combined magnetic track and wheel brake. For somewhat less onerous conditions the magnetic track brake will suffice. Heavy cars and frequent stops from high speed make serious calls upon the driver's strength when hand brakes are used. The use of compressed air or the momentum brake is worth consideration under such conditions. Skidding is always the danger. Cleaning and watering of the rails is a better remedy than sanding them. Track brakes go far to prevent skidding. Electric brakes should be applied before hand brakes whenever used—never in the reverse order. The diligent training of drivers, and such routine procedure that they shall instinctively make the best use of their brake power under all circumstances, is the most effective safeguard against runaway and collision accidents. Every emergency brake should be a service brake and used as such.—Lond. *Elec.*, November 2.

Electric Automobiles.—SIEG.—While the gasoline motor car is especially suitable for long-distance runs, the electric automobile is specially adapted to city service and should be able to replace horse traction. If at the usual speeds of 25 to 30 km. per hour the cost of operation shall be a minimum, the storage battery must give at least 30 watt-hours per kg. Storage batteries giving this output are now made by two German storage battery factories who are interested in automobiles. The author discusses with the aid of diagrams a great many details of electric automobile construction.—*Elek. Zeit.*, November 1.

Locomotive.—An illustrated description of a locomotive exhibited at the Milan Exposition. The locomotive has been ordered by the Belgian State Railways. It is operated by an electric generating set consisting of a dynamo and a gasoline engine and by a battery connected in parallel with this generator set. The construction is described in detail.—*L'Eclairage Elec.*, November 3.

Installations, Systems and Appliances.

Electricity in Houses.—HILLMAN.—A fully illustrated description of the various applications of electricity in his house in which the electrical current is used for all possible purposes, for lighting, heating, cooking, power purposes, etc. In planning the house the author had two sets of specifications prepared, one including the cellar excavation for coal and wood storage under the entire house, and a kitchen range with its inevitable chimney. The other specification was with only half the cellar excavated, the other half of the foundation going down only to the frost line, with no provision for a kitchen range and kitchen chimney, but including the installation of heating and cooking circuits and outlets in addition to the lighting circuits. When the estimates were examined it was found that the difference in cost between the first and second plans was so much in favor of the second that the amount saved was more than sufficient to purchase the entire electric kitchen equipment and all the other small electric utensils used throughout the house. The extra cost of wiring was about $125, or less than 1 per cent of the total investment.—*Cassier's Mag.*, November.

High-Tension Insulator.—A description of a new type of high-tension insulator devised by Semenza. The design is especially intended to avoid breaking down troubles at times of heavy rain. Instead of relying on the uppermost porcelain petticoat, above which the wire is supported, to shield the lower part of the insulator from rain, as is done in the older types of insulator, a wide protecting hood is placed at the top of the insulator after the manner of an umbrella. As a result the lower petticoats need not be nearly so large in size as in the older forms. It is unnecessary to make the hood of expensive porcelain, as it plays no part in resisting puncture. The whole insulator is lighter than the older designs for the same breakdown voltage under rainy conditions, and has the further advantage that the point of attachment of the wire is lower, so that the strain on the insulator pin is much reduced. The article in the Italian journal is illustrated with a number of photographs showing the nature of the discharge obtained by pushing up the testing voltage to the breaking down point as compared with an ordinary insulator. Insulators of this type of quite moderate dimensions have been tested successfully up to 110,000 volts in heavy rain. It is claimed that there is a saving in cost of from 30 to 40 per cent in insulators for voltages up to about 40,000 by the adoption of the new type, and about 50 per cent is thought to be the probable gain with insulators for from 80,000 to 90,000 volts. (An illustrated description of the Semenza insulator was published in our issue for August 11, 1906.)—Abstracted from *L'Ellettricita*, in Lond. *Elec.*, October 26.

Wires, Wiring and Conduits.

Transmission Lines.—BLONDEL.—A continuation of his mathematical paper on a practical method for the calculation of alternating-current lines having both self-induction and capacity.—*L'Eclairage Elec.*, November 3.

Cables.—COALES AND RUSSELL.—Two letters on formulas for the capacity currents in three-core cables.—Lond. *Elec.*, October 26 and November 2.

Electro-Physics and Magnetism.

Mechanical Theory of Electricity.—Witte.—In modern physics there are three distinct fields: mechanics, thermodynamics and electrodynamics. There seems no trouble in assimilating thermodynamics with either of the other two fields, but the problem is unsolved whether—for the purpose of a uniform theory of natural phenomena—electrodynamics should be resolved into mechanics or mechanics into electrodynamics. Many attempts have been made to give a mechanical explanation of electrical phenomena in which hypotheses concerning a continuous or discontinuous ether play an important part. The author gives in the present paper a classification of all the different attempts which have been made in this direction, together with a critical discussion.—*Phys. Zeit.*, November 1.

Conductivity of Heat and of Electricity.—Reinganum.—The electronic theory leads to the calculation of the ratio of the conductivity of heat to that of electricity in metals. However, according to the simplest form of the theory (Lorentz) this ratio would be the same for all metals, which is not the case in reality. The present author has tabulated the results of measurements and shows that the ratio depends on the atomic weight as well as on the magnetic character of the metal, both of which properties should be taken into account in a complete theory.—*Phys. Zeit.*, November 1.

Conductivity of Oxides and Sulphides.—Koenigsberger and Reichenheim.—An account of measurements of the conductivity of oxides and sulphides of iron and lead. The chief result is that the conduction of metallic oxides and sulphides cannot be of the electrolytic kind, and that it must therefore be metallic conduction; yet the course of the resistance is different from that in metals and the resistance temperature curve is very peculiar. The higher the temperature the more closely does the electrolytic behavior approach that of the metals. The lower the temperature the more pronounced is the increase of resistance.—Lond. *Elec.*, November 2.

Electronic Theory.—Planck.—A paper in which the author critically discusses the measurements of Kaufman of the magnetic deviation of beta rays in their relation to the dynamics of electrons.—*Phys. Zeit.*, November 1.

Magnetization and Electric Conductivity.—Grunmach.—An account of an experimental investigation of the influence of transversal magnetization on the electric conductivity of metals. Though the effect is very small, it was studied in great detail by the author, the results being given in diagrams and tables. Of the ferro-magnetic metals nickel shows the greatest diminution of resistance in strong fields, cobalt follows and then comes iron. The results may be used as a basis for a theory of the motion of electrons in metals.—*Phys. Zeit.*, November 1.

Waves of Magnetic Flux Along Wires.—Lyle and Baldwin.—An account of very careful experiments on the changes in the Fourier characteristics of longitudinal waves of magnetic flux along iron wires and rods. These flux waves are started at the middle points of the rods or wires by sending alternating current through short coaxial solenoids placed there.—*Phil. Mag.*, November.

Sodium Vapor.—Wood.—An account of an experimental investigation of fluorescence and magnetic rotation spectra of sodium vapor and their analysis.—*Phil. Mag.*, November.

Evolution of Gas from Cathodes in Vacuum Tubes.—Skinner.—The author had formerly found that during the first few minutes after starting a glow current through helium in a vacuum tube, hydrogen is given off by a metallic cathode at a rate determined by Faraday's law for electrolytes. Further, if a carbon cathode be used in helium, nitrogen is evolved by it, within certain time limits, according to the same law. But if a current be passed between metallic electrodes in hydrogen or between carbon electrodes in nitrogen, the increase in gas pressure in the discharge tube (by which the evolution of gas is detected) is relatively small. The difference between the observations with helium on one hand and with hydrogen and nitrogen on the other hand was traced to anode absorption of the latter two (that of helium being inappreciable) under the assumption that the rate of evolution of gas from a given cathode is determined by the current alone, irrespective of the kind of gas in the discharge tube, the experimental results indicated that the anode absorbs hydrogen and nitrogen, when these are used as filling, at a rate also determined by Faraday's law. The author has now experimentally confirmed this conclusion and has shown that the rate of evolution of gas from the cathode is the same irrespective of the gas filling used.—*Phil. Mag.*, November.

Electro-Chemistry and Batteries.

Storage Batteries.—The first parts of a paper by Wahter entitled "Observations on the Lead Accumulator," discussing the commissioning of a new cell, the working of the cell, sulphating, desulphating by boiling, deposit of sulphating and washing, and the decommissioning of the cell and the deals with the materials used in the cell, the structural considerations. Sulphating is noticed as the cause of buckling. The same issues contain a continuation of a serial by Vicarey on the treatment of storage batteries. The author discusses how to counteract sudphating and then describes the indications which appear of irregularities of plates or electrolytes.—*The Elec. Accum.*, September and October.

Action of Electrolytes on Colloidal Solutions.—Burton.—An account of an investigation in which the author found that the addition of small quantities of aluminum sulphate to colloidal solutions of silver and gold brings about a decrease in the charge of the particles and even a reversal of the sign of that charge. He calculated the charge on the colloidal silver and gold particles and found that the charge on a gram equivalent of colloidal silver is 0.04 of the charge corresponding to a gram equivalent of a univalent ion, while the charge on a gram equivalent of colloidal gold is 0.12 of the charge corresponding to a gram equivalent of a univalent ion.—*Phil. Mag.*, November.

Zinc Coating for Iron and Steel.—Cowper-Coles.—A paper on electropositive coatings for the protection of iron and steel from corrosion. He describes the different methods, first, of hot galvanizing; second, of electrolytic coating with zinc, and third, of producing a zinc coating on steel articles in a closed receptacle containing zinc dust heated from the outside. Various applications of the latter method, which is called "sherardizing," are dealt with in detail.—Lond. *Elec.*, October 26 and November 2.

Units, Measurements and Instruments

Moving-Coil Galvanometers.—White.—A long mathematical paper on every-day problems of the moving-coil galvanometer. All such galvanometers when critically damped by the coil alone are subject to three conditions. The first of these is that the galvanometer during deflection utilizes nearly 16 per cent of the energy due to the steady current, $I^2R\,T$. The second is the well-known relation between moment of inertia, moment of torsion and periodic time. These conditions lead to the familiar relations between sensibility, period, resistance and controlling force. The third is the well-known condition for critical damping. For the moving-coil galvanometer this condition may be expressed in a new and convenient form as a relation between the periodic time and the field strength, modified by the ratio between external and internal resistance, and also to a slight extent by the form of coil. The period, therefore, is practically determined by the field strength, no matter what the sensibility may be. To the three generally recognized points of excellence in moving-coil galvanometers it therefore seems desirable to add a fourth. The four points then are: First, steadiness of the coil which depends upon accuracy of construction, but more upon the conditions under which the instrument is used; second, smallness of controlling force, which depends upon delicacy of construction; it is an advantage which may be variously used to secure large sensibility, high resistance or shortness of period. Third, ability to secure short period, which depends essentially upon field strength. Whether a short period is consistent with a given sensibility, etc., depends upon the delicacy of construction. The question here is of the ability to secure the short period at all in a critically damped instrument. Fourth, constancy of zero, which is wholly a question of magnetic action; it depends upon the shape of the field and the width and magnetic purity of the coil; it also increases as the period becomes shorter and the coil resistance greater. The advantages of light coils are often insufficiently appreciated. High normal sensibility, combined with

shortness of period, is the real test of skill in galvanometer construction. A high total (critical) resistance increases the difficulty of securing these advantages. Auxiliary dampers diminish sensibility, but have certain obvious advantages. Under some conditions they diminish the possible period more than they do the sensibility. This action may be greater with air and oil than with magnetic dampers. It is possible to determine within 10 per cent the field strength of a galvanometer by measurements of time, sensibility and resistance, combined with inspection of the coil. Nearly all that is practically important in the theory of moving-coil galvanometers can be included in three short equations between quantities which can easily be determined for most instruments. Computation, therefore, can be easily and advantageously employed in adapting a galvanometer to any particular task. The ballistic galvanometer, as usually employed, with an impulsive discharge of very short duration, is very inefficient. The quantity of electricity required to produce a given deflection is of the same order of magnitude as with the steady current instrument, but the energy is far greater. As the time of the discharge approaches the periodic time of the galvanometer, the efficiency increases.—*Phys. Rev.*, November.

Transformers for Instruments.—THOMPSON.—If transformers employed in connection with instruments are to be used on a high-pressure circuit, the insulation requirements lead to remarkable proportions. A 60,000-volt series transformer has a total height of 8 ft. and its capacity is 40 watts. In connecting it to the high-voltage line, a spark-gap is provided in shunt with the

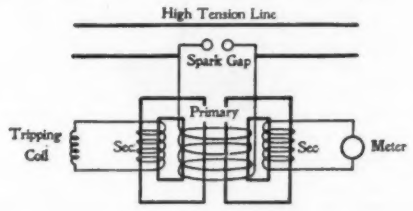


DIAGRAM OF TRANSFORMER WINDINGS.

primary winding to act as a protection to the primary coil in case line surges should occur, which might injure the internal insulation of the primary coil. In some cases it is desirable to operate both meters and circuit-breaker from the same transformer. In such cases a transformer with separate and independent secondaries is provided, as shown in Fig. 1. A spark-gap is also used here in shunt with a single primary coil, as described before.—*Elec. Jour.*, November.

Chilled Cast Iron for Permanent Magnets.—CAMPBELL.—Peirce has found that chilled cast iron is in many instances a suitable material for permanent magnets, and this is confirmed by the present author. All the test pieces—rods as well as rings—were heated to 1,000° C. in a gas-muffle furnace, and the pieces were then removed and quickly chilled in water at the temperature of the room, of course, with proper precautions on account of the brittleness of the pieces. The pieces were then magnetized to saturation by means of a very strong electromagnetic field. Four pieces of chilled cast iron showed values of maximum remanence varying between 1,670 and 1,850 and values of coercivity varying between 48.9 and 52.8, which compares not unfavorably with the results obtained with two pieces of magnetic steel showing a maximum remanence of 2,550 and 2,950 and a coercivity of 55.5 and 73.0. The experiments show that large cast-iron magnets can be made cheaply and easily. The attention of instrument makers is called to this fact.—*Phil. Mag.*, November.

Potentiometer.—DIESSELHORST.—A description of a low-resistance potentiometer having a resistance of 12 ohms, with five dial decades, or three dial decades supplemented by a contact wire. The author was led to its construction in the course of work on thermal conductivity and the electric properties of the metals, in which a number of small e.m.f's had to be measured with considerable accuracy in quick succession. The high resistance of the usual instruments was found to reduce the sensitiveness to an inconvenient extent. The author believes his instrument to be useful in view of the increased use of thermo-elements. The construction is illustrated by diagrams.—From *Zeit. f. Instrumentenk*, abstracted in Lond. *Elec.* October 26.

Resistance Thermometer.—BRUGER.—An illustrated description of a recording electric resistance thermometer which is specially suitable for plotting fever temperatures. A division of 0.7 mm. is obtained for 0.1° C.—*Phys. Zeit.*, November 1.

Röntgen Screen.—DANNEBERG.—Zinc sulphide is specially suitable for Röntgen screens since it gives a clear after-picture which may easily be annihilated after the observation is made so that the screen may be used at once anew.—*Elek. Zeit.*, November 1.

Testing.—FAY.—In a continuation of his serial on the testing of large motors, etc., he describes tests of induction regulators.—*Elec. Jour.*, November.

Telegraphy, Telephony and Signals.

Telephone Lines.—GATI.—A short article in which a discussion of telephony is based on Steinmetz's conception of effective resistance, effective reactance, effective conductance and effective susceptance. The author mentions the advance made by Kennelly's method of using the barretter for measuring telephone currents. He describes a combination of this method with the three-ammeter method of measuring power. The chief interest in the article lies in the measurement of the effective inductance. It is generally thought that leakage caused by imperfect insulation and effective inductance are identical. But Breisig found in a cable the effective inductance to be a thousand times greater with high-frequency currents than that corresponding to ordinary leakage. The chief conclusion of the author is that the conductance is never negligible, and especially with high frequencies it has values different from those hitherto accepted. "It would be very interesting to make investigations on loaded lines, because it seems that an increase in the self-inductance alone is not sufficient for long-distance telephony; the conductance depending on the capacity, it is important to reduce the latter as much as possible."—Lond. *Elec.*, November 2.

Miscellaneous.

President's Address.—WILKINSON.—His address to the Leeds Section of the British Inst. Elec. Eng. In the first part he calls attention to the necessity of greater economy in the boiler room, and makes various suggestions in this direction. Speaking of the new high-efficiency incandescent lamps he says that those systems which retained the 100 or 110 voltage and did not double it are likely to reap a rich reward in the near future for their customers from the new lamps. He has used such lamps in his house since July last, each giving a light equal to 32 British candles for an expenditure of under 40 watts. "With electricity at 6 cents per kw-hour and including the extra retail price of the metallic filament lamps as against the carbon lamps, and assuming an average life of only 600 hours for the metallic filament lamp, the relative cost comes out, for 32-cp lamps, for the 600 hours at $2.75 in the former case as against $4.43 for the latter." From results in his house, the useful life of the metallic filament lamps will average at least double that of the carbon lamps, while they are not so sensitive to voltage variation, give a more brilliant quality of light, and the bulbs on normal voltage do not blacken, hence the candle-power is more uniform throughout the life of the lamp. He finally makes some general remarks on tariff for electric light and power.—Lond. *Elec.*, November 2.

Milan Exposition.—An illustrated description of exhibits of the Westinghouse Company and of the International Company of Electricity of Liege at the Milan Exposition; the latter company exhibited gasoline electric locomotives.—*L'Eclairage Elec.*, November 3.

Books Received.

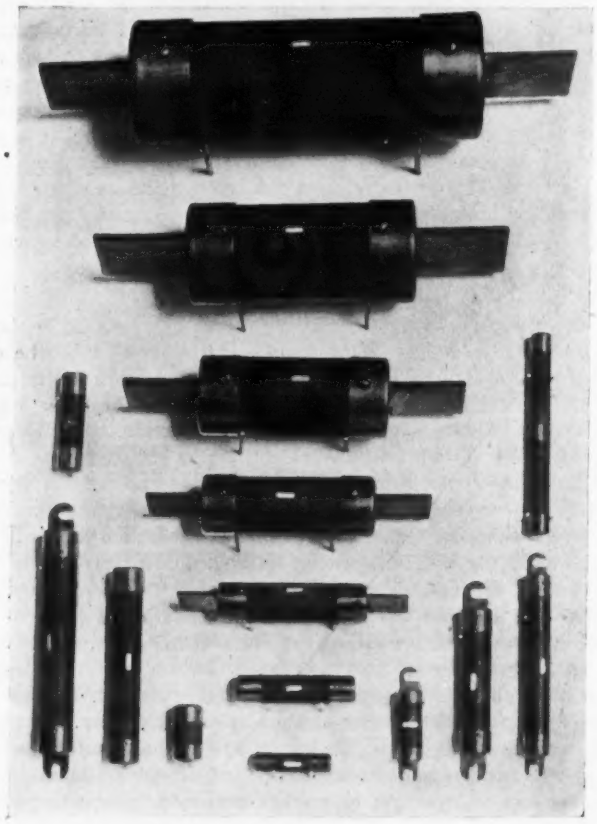
ELECTRICITY AS APPLIED TO MINING. By A. Lupton, G. D. Aspinall Parr and H. Perkin. Second Edition. New York: D. Van Nostrand Company; London: Crosby, Lockwood & Son. 310 pages, 190 illustrations. Price, $4.50.

ELEMENTARY PRINCIPLES OF CONTINUOUS-CURRENT DYNAMO DESIGN. By H. M. Hobart. London and New York: Whittaker & Company. 220 pages, 106 illustrations. Price, $3.00.

Union Enclosed Fuses.

The Chicago Fuse Wire & Manufacturing Company has for some time been developing a line of enclosed cartridge fuses, the 250-volt line having been approved recently by the Underwriters. The design of these fuses has been in charge of Mr. C. P. McDonald, electrical engineer of the company, who was formerly connected with the Underwriters' Laboratories at Chicago. The company moved its factory from Buffalo to Chicago the first of the present year and its capacity has been much enlarged since that time.

The accompanying illustration shows the 250-volt fuses from 1 to 600 amp. In the design of the Union fuse three objects were kept in view. The first is the generation of a minimum amount of heat consistent with a brake of sufficient length to extinguish the arc. By using a very short initial break—that is, by narrowing the ribbon which forms the fuse—for a very short space the total heat required to be generated in the fuse in advance of blowing would be minimum, but the arc would hold over and prevent prompt interruption of the circuit. The second point kept in view is accuracy of rating. This is accomplished by stamping out the various elements, close calibration of the fuse material,



UNION ENCLOSED FUSES.

uniformity of filling and testing to determine that the various elements are the same as on previous samples. Zinc is used as the fusible element, as in most other enclosed fuses. Third, the proper operation at the time of fusion is of course all important. Vent holes are provided in the ends of the caps, asbestos wool being placed in the caps to prevent the escaping of the molten metal.

The selection of a filler is the most difficult problem in the design of any enclosed fuse. The filler must be a poor conductor of heat, so that the tube will not be injured when the fuse blows; it must not liberate gases under action of the arc and must not be affected by absorption of moisture in a way that will cause it to harden in time and form cracks which will hold molten fuse metal. The object of the filler on a fuse is to exclude air; to insure uniformity of conditions so as to have the fuse blow close to its rating; and most important of all, to smother the arc. A successful filler to meet these requirements has been devised by Mr. McDonald for the Union fuses. Each fuse is tested for continuity of circuit and is inspected before shipment for defective caps or blades out of line. Testing apparatus is being provided for all classes of fuses. The Underwriters' test comprises a dead short-circuit on the voltage for which a fuse is rated, and a test to determine the accuracy of rating. The company makes new and old code cartridge fuses for from 1 to 600 volts in addition to its old line of link fuses and refills and makes special fuses of all dimensions.

Adjustable Lamp Brackets.

The accompanying illustrations show two styles of Wallwork universal electric lamp brackets now being placed on the market.

FIG. 1.—ADJUSTARLE LAMP BRACKPT.

In nearly all kinds of shops and factories employing skilled labor at machines and benches there is need for an adjustable fixture whereby light can be directed upon the work, and the fixture illustrated was designed to fulfill the need for inexpensive, substantial and rugged fixtures by which the light can always be put in the right position.

The brackets are made wholly of black enamelled iron with universal ball and socket and elbow joints. The bases, joints and globe or protection holders are of malleable cast iron and the tubing of standard ½-in, ⅜-in. and ¼-in. gas pipe. All brackets are provided with chain pull sockets. The elbow joints are formed of cup-shaped castings, the edges of which are tongued and grooved with sufficient space inside to prevent chafing of the wire insulation with the danger of short-circuits after a few

FIG. 2.—ADJUSTABLE LAMP BRACKET.

months' use. At the present time the brackets are made in ten styles, including wall, ceiling and work bench lights, double and single desk brackets and special patterns to be attached to lathes, planers and other shop tools.

Wallwork's patent universal lamp brackets are manufactured in the United States by the Wells Light Manufacturing Company, 44 Washington Street, New York.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—The colder weather of the past week had a stimulating effect on trade, and mercantile collections were somewhat improved, although the rates for money continued high. Transporting facilities are still far inadequate and in some cases congestion is serious. Complaints of poor delivery are widespread, and while the railways are making every effort to remedy the situation little progress is being made in that direction. This condition of affairs has a retarding influence on the distribution of merchandise. Seasonable lines of wearing apparel and holiday goods attracted most attention, while staple articles of every description were in steady demand. Current business is good and prospects for the future are very bright. Labor disputes reach amicable settlement in most cases, wages being advanced in numerous transportation and manufacturing industries. The most striking development of the week was the unprecedented output of pig iron in conjunction with large imports and advanced prices, indicating the greatest activity ever attained by the steel mills. Like gratifying reports come from other industries. Railway earnings for the first week of November were 7.7 per cent larger than a year ago, and foreign commerce at the port of New York for the week showed a gain of $1,531,875 in imports and a loss of $957,630 in exports, as compared with the same period last year. Rates for money were very high early in the week, but receded later. Interior points, especially in the cotton belt of the Southwest, seem to be pretty well supplied with funds, owing to the large crops and the freer movement of cotton. The demand for special pig iron, domestic and foreign, is as insistent as ever, and the high prices prevailing have not curtailed consumption. Domestic production in October passed all monthly records, and at present the blast furnace capacity of the country is growing to the rate of 26,000,000 tons per annum. Finished lines, except structural shapes, continue very active. New orders for steel rails aggregate 100,000 tons for 1907 delivery. Machinery makers are very busy. Copper is quiet but firm. Brokers report numerous inquiries for prompt delivery of electrolytic, Lake and casting stock. Little business was done as the producers and jobbers have nothing to speak of for shipment until January. Quotations are 22 to 23c. for February and March electrolytic; 22¾ to 23c. for Lake for the same months, and 22½ to 23c. for casting stock. *Bradstreet's* reports 222 business failures during the week ending November 15 against 198 in the previous week and 190 in the corresponding period of 1905.

NATIONAL BRAKE & ELECTRIC COMPANY.—Among recent orders for air brake equipments, the National Brake & Electric Company, Milwaukee, Wis., reports the following, many of which are repeat orders: Chicago Traction Company, 120 equipments; United Railroads of San Francisco, Cal., 110 equipments; Seattle Electric Company 38 equipments; and 14 trailers; Norfolk & Portsmouth Traction Company, Norfolk, Va., 33 equipments and 8 trailers; Chattanooga Railway Company, 27 equipments; Northern Ohio Traction Company, Akron, Ohio, 20 equipments; Washington Water Power Company, Spokane, Wash., 16 equipments and 5 trailers; Rhode Island Company, Providence, R. I., 14 equipments; Public Service Corporation, Camden, N. J., 13 equipments; Oakland Traction Construction Company, Oakland, Cal., 10 equipments; Georgia Railway & Electric Company, Atlanta, Ga., 10 equipments; St. Louis Car Company, for Tampa & Sulphur Springs Railway, Tampa, Fla., 8 equipments; Illinois Steel Company, South Chicago, Ill., 8 equipments; Union Street Railway Company, New Bedford, Mass., 6 equipments; Central Pennsylvania Traction Company, Harrisburg, Pa., 6 equipments; Augusta-Aiken Railway & Electric Company, Augusta, Ga., 4 equipments; R. W. Blackwell & Company, Ltd., (foreign), 6 equipments; Knoxville Railway & Light Company, Knoxville, Tenn., 3 equipments; Spokane Traction Company, Spokane, Wash., 3 equipments; Lookout Mountain Railway Company, Tennessee, 2 equipments; McGuire-Cummings Company, Chicago (car builders), 2 equipments; Butte Electric Railway Company, Butte, Mont., 2 equipments; Illinois Traction System, Danville, Ill., 1 equipment; Johnstown Passenger Railway Company, Johnstown, Pa., 1 equipment; International Railway Company, Buffalo, N. Y., 1 equipment; Duluth Street Railway Company, Duluth, Minn., 1 equipment; Indiana, Columbus & Eastern Traction Company, Newark, Ohio, 1 equipment. In addition, the company has received orders for over 800 of the new Type N oil-pneumatic governors and 400 emergency valves since the close of the recent Columbus convention.

THE PITTSBURG GAGE & SUPPLY COMPANY, Pittsburg, Pa., is installing a large number of White Star continuous oiling systems. The simplification of handling oil, the feeding of a regular supply to the bearings, the elimination of wastage over hand oiling and the mechanical purification of the used oil thereby cutting the oil bills down and reducing cost of attention to a minimum, with the certainty of copious lubrication, has led such representative concerns as the following to specify and install the White Star system: Brier Hill Iron & Coal Company, Youngstown, O.; Embree Iron Company, Embreeville, Tenn.; Bullock Electrical Manufacturing Company, East Norwood, O.; Sargent & Co., New Haven, Conn.; National Car Wheel Company, West Homestead, Pa.; Copper Queen Construction Manufacturing Company, Douglas, Ariz.; Brush Electric Light & Power Company, Galveston, Tex.; Illionois Steel Company, Joliet, Ill., and the Consolidated Gas, Electric Light & Power Company, Baltimore, Md. A copy of the company's catalogue on oiling systems may be had by anyone interested.

THE ROBERTS & ABBOTT COMPANY is making a minute examination of a large water power located at what is known as the Ox Bow of the Snake River in Eastern Oregon. At this point the river makes a loop about two and a quarter miles long, the distance across the loop amounting to but a few hundred feet at the narrowest point. It is proposed to erect a dam at the narrow point 30 feet high and put a tunnel through the neck of the loop, thus getting 22 feet additional fall, making a total drop of 33 feet. Mr. W. H. Abbott, of the Roberts & Abbott Company, is now in Oregon checking up measurements and determining the minimum flow of water. It is said that in the dryest years there will be a flow at extreme low water of 5,000 second-feet of water, which would give a minimum power of 25,000 hp. The feasibility of transmitting this 140 miles to the various mines in the Seven Devils and Cornucopia country and the towns of Huntington, Weiser, Payette, Ontario and Boise is being considered.

ELECTRICS IN CALIFORNIA.—Advices from California state that the Northern California Power Company, which is already selling its surplus power to the Pacific Gas & Electric Company, is to be taken over completely and made a subsidiary concern. It is the largest competitor in actual operation and is paying regular dividends. The proposed taking over of the Fleishhacker interests, including the Truckee General Electric Company, the American River Electric Company and the Central Traction Company is said to have been declared off indefinitely for lack of agreement. The North Mountain Power Company, operating in Trinity and Humboldt counties, is said to be acceptable to the combine, but the Snow Mountain Power Company's proposition, a larger concern projected by the same owners—George W. Scott and his associates—has been turned down. Mr. John Martin is interested in the present consolidation.

GENERAL ELECTRIC OFFICES.—F. R. Wood & Company have sold for the General Electric Company to the City Investing Company the Edison Building, Nos. 42 and 44 Broad Street, New York City, extending to Nos. 38 and 40 New Street. It is an eight-story structure, occupying a plot 41.3x154.5x64.4x158.1 feet. It partly occupies leased ground. The General Electric Company owns the building and one-half the fee. The officers of the General Electric Company desired to move to a building in which the local staff of the company could be accommodated on one floor. They will be able to carry out their plans, as they have leased a floor in the City Investing Company's building, being erected in Cortlandt Street, between Church Street and Broadway. The yearly rental for the Cortlandt Street building floor will be $50,000. Each floor of the building will have about 19,000 square feet of rentable space.

RAILROAD SHOP PLANT.—In addition to the two alternating current generators now in operation at the Kingsland repair shops of the Delaware, Lackawanna & Western R. R., there is to be in stalled an additional alternating current engine type generator of 300 kw, 480 volts, 225 r.p.m., three-phase, 60

cycles to furnish the increased demand for power. The two alternating current machines have been working a little over a year and have been so successful as well as economical in their operation that the railroad has re-ordered the new generator from the Crocker-Wheeler Company. This is only one of the many instances where large additions have been made to power house and shop equipments in less than a year after the installation of the first Crocker-Wheeler motors and generators.

GENERAL RAILWAY SIGNAL.—It is officially announced from Rochester that the general offices and Buffalo plant of the General Railway Signal Company will be moved to that city. The capacity of the local plant will be greatly enlarged. New buildings with floor space of 100,000 square feet are to be erected. The contract has been awarded to Westinghouse, Church, Kerr & Company. Removal will be begun in February and completed in May without interruption to the company's business. The company has the contract for the signaling equipment of the New York Central and of the New York, New Haven & Hartford electrified zone.

STURTEVANT GENERATING SETS.—Among numerous sales of Sturtevant generating sets consisting of enclosed forced lubrication engines and generators built by the same company may be included the following: Washburn Bros. Company, Jersey City, N. J.; Saginaw & Manistee Lubricating Company, Williams, Ariz.; Blackmar & Post Pipe Company, St. Louis, Mo.; Tabor Glove Company, Milwaukee, Wis.; Hudson Companies, Jersey City, N. J.; Dixfield Light & Improvement Company, Dixfield, Me.; Drayton Mills, Spartanburg, S. C., and E. H. France Sons, No. Baltimore.

THE WESTINGHOUSE MACHINE COMPANY has an order for three turbine generator units, each of 6,000-kw. capacity, for the Philadelphia Rapid Transit Company's Wyoming Avenue power station. These with the one now in course of erection will make four units of 6,000-kw capacity each in this station. Six 1,500-kw Westinghouse turbine generator units have been operating in this station for the past year, and it is their performance that led to the placing of the order for the four 6,000-kw units, making this one of the largest power stations in the country.

ADVANCE IN PRICES.—A general advance of price has been going on in electrical lines, induced by the generally higher cost of material and labor, and particularly by the rising quotations on copper. The General Electric Company has, as noted, issued a formal statement on the subject. Last week a further advance was made in incandescent lamps, when what are known as Class B lamps were marked up 1 cent a lamp, the difference between them and Class A lamps hitherto having been 2 cents.

INCANDESCENT LAMP WORKS.—Advices from Central Falls, R. I., of November 13, say: "The Farwell Worsted Company's mills were sold by public auction here to-day. The purchaser was B. B. Tremaine, of Cleveland, O., who was acting for the Bryan Marsh Company, of New York, manufacturers of electric incandescent lamps. The Bryan Marsh Company now has a factory at Marlboro, Mass., but will extend its business in Rhode Island and employ about five hundred hands."

MARINE EQUIPMENTS.—The B. F. Sturtevant Co. of Hyde Park, Mass., has recently supplied a number of generating sets for marine equipment, among which may be enumerated two sets for steamers *Powerful* and *Dreadnaught*, four sets for Metropolitan Steamship Company's *Yale* and *Harvard*, one for the Old Dominion steamship *Jefferson*, one for the United Fruit Company's steamer, and several for the New York municipal ferry boats.

PHILADELPHIA ELECTRICAL COMPANY.—The partnership existing between A. H. Manwaring and C. L. Bundy, under the name of the Philadelphia Electrical Manufacturing Company, at 2011 Market Street, has been dissolved, and the business has been taken over by the Philadelphia Electrical & Manufacturing Company, which will assume all liabilities and carry the business on as before. Mr. Bundy is treasurer of the new concern.

MECHANICAL DRAFT APPARATUS.—The following concerns are installing mechanical draft apparatus furnished by the B. F. Sturtevant Co., of Hyde Park, Mass.: Mitchell Motor Car Company, Racine, Wis.; General Chemical Company, Bayonne Works, Constable Hook, N. J.; Brown & Sharpe Mfg. Company, Providence, R. I.; Mahanoy City Light, Heat & Power Company, Mahanoy City, Pa., and Otto Lorence & Company, New York City.

UNIPOLAR DYNAMO CONTRACT.—The Alpha Cement Company has made a contract with the Westinghouse Electric & Manufacturing Company for a unipolar dynamo of 2,000-kw capacity, operating at 250 volts potential. It is to be driven by a steam turbine.

Financial Intelligence.

THE WEEK IN WALL STREET.—There was a general improvement in stock prices, due to the better money market conditions, but speculation was narrow and professional with high-priced manipulative stocks, like St. Paul, as the leaders. There was a flurry in call money rates, but the market eased off later on, although time funds were firmly held. The heavy break in Standard Oil on the Government's proceedings against that company did not affect other securities. The steel stocks were somewhat neglected, but Colorado Fuel was more or less of a feature in the later trading, and among the other industrials the United States Rubber stocks assumed a prominent position. Electric stocks were generally firmer and advances were the rule. Westinghouse was the prominent exception, common losing 2½ points and preferred 14½, the closing quotations being 155 and 162, respectively. General Electric made a gain of 2½ points, the closing quotation being 174½; Allis-Chalmers common advanced ⅝ and preferred 2¼ points, the closing prices being 17½ for the former and 46¼ for the latter. American Locomotive scored advances in both common and preferred, the former closing at 75 and the later at 112. A fair business was done in Brooklyn Rapid Transit, the last quotation, 79, being within a fraction of the highest point of the week. Interborough-Metropolitan common closed at 37½, which is a net gain of ⅞, and preferred at 77¾, an advance of 1 point. American Telegraph & Cable is down 2 points, closing at 88; and Western Union is unchanged to 85⅜. The feature of the curb market was the sale of perhaps 1,500 shares of Standard Oil—the record as to quantity for some years. There was the same enthusiasm in mining shares as has prevailed for some weeks, while the general list was rather neglected. The week ended with some considerable gains in spite of liquidation which had been in progress. The closing quotations of Nov. 20 are given in the accompanying table:

NEW YORK

	Nov. 13	Nov. 20		Nov. 13	Nov. 20
Allis-Chalmers Co.	16¾	17⅛	General Electric	174	178
Allis-Chalmers Co. pfd.	44½	46	Hudson River Tel	...	...
American Dist. Tel	25	25	Interborough Rap. Tran.	...	...
American Locomotive	72¾	75¼	Mackay Cos.	71½	73
American Locomotive pfd.	111	111	Mackay Cos. pfd.	69	...
American Tel. & Cable	85	88	Marconi Tel	...	...
American Tel & Tel.	...	...	Metropolitan St. Ry	...	...
Brooklyn Rapid Transit	76¾	78	N. Y. & N J. Tel	...	...
Electric Boat	16	24	Western Union Tel.	85¼	85⅜
Electric Boat pfd	55	70	Westinghouse com.	155	154
Electric Vehicle	12	...	Westinghouse pfd.	...	...
Electric Vehicle pfd	18	...			

BOSTON

	Nov. 13	Nov. 20		Nov. 13	Nov 20
American Tel & Tel.	138	137½	Mass. Elec. Ry. pfd	69	69½
Cumberland Telephone	...	...	Mexican Telephone	3⅛	3⅜
Edison Elec. Illum.	...	232	New England Telephone	...	129½
General Electric	...	180¼	Western Tel & Tel.	9	...
Mass. Elec. Ry.	18¾	19	Western Tel. & Tel. pfd.	...	80

PHILADELPHIA

	Nov. 13	Nov. 20		Nov. 13	Nov. 20
American Railways	51⅛	51¼	Phila. Electric	8⅝	8¾
Elec. Co. of America	11⅞	12	Phila. Rapid Trans	25	21½
Elec. Storage Battery	71	70	Phila. Traction	97¼	...
Elec. Storage Battery pfd.	...	...			

CHICAGO

	Nov. 13	Nov. 20		Nov. 13	Nov. 20
Chicago City Ry.	150	...	National Carbon	85	90
Chicago Edison	145	143	National Carbon pfd.	...	117
Chicago Subway	...	51¾	Union Traction	...	...
Chicago Tel. Co.	...	118	Union Traction pfd.	...	...
Metropolitan Elev com.	25	26			

MICHIGAN STATE TELEPHONE.—The Michigan State Telephone Company has sold $1,250,000 3-year 6 per cent coupon debentures, dated November 1, 1906, in Boston. On September 1 last the company had a net floating indebtedness of $1,489,855, contracted wholly by reason of new construction. The officials of the company estimate that the proceeds received from the sale of these $1,250,000 3-year debentures will permit the retirement of all indebtedness maturing prior to January 1, 1907. The Michigan State Telephone Company has been enjoying an exceedingly prosperous year. Up to the end of September the gain in stations was nearly 13,000, which is greater than the entire increase of 10,700 during 1905. This expansion has cost money, however, and expenditures for new contruction this year are esti-

mated at approximately $2,000,000. Further larger growth and consequent expenditures are anticipated during 1907. A part of these additional expenditures will be financed by the issuance of the balance of $2,000,000 6 per cent debentures.

NEW YORK TELEPHONY.—With regard to the present prospect of a long delay in establishing independent telephony in New York, President D. A. Reynolds, of the Great Eastern Company, has issued a statement reviewing the legal steps that have been taken by his corporation in its efforts to establish a competing telephone service in the city of New York. The conclusions of this statement are as follows: "From all the litigation thus far three things have been established: First, the company's corporate life is unimpaired; second, the company's perpetual franchise is irrevocable; third, the company cannot build its own conduits, but may occupy the present system, and additional conduits must be provided if present facilities are inadequate. The company prefers to build its own conduits, believing it yet has that right. It can, however, go into the conduits controlled by the Bell Telephone interests the same as the Bell interests are forced to occupy the subways built by the State Line Telephone Company at Peekskill. Whether the company builds or rents its conduit facilities is immaterial to the public, so long as the people secure competition, and the difference to the company is measured by its profits. In any event it will build a competing system in New York, and the city authorities expect it. The city has taxed the company upon its franchise ever since the franchise tax law became operative, and the tax has been promptly paid. It has paid its taxes to the State and every other legitimate claim that has come against it. It has appealed from the decision of the Appellate Court to the Court of Appeals and is prepared to defend what it believes to be its rights in the court of last resort, and in any event build a competing telephone system in the city of New York."

NEW YORK TRACTION.—The rival New York & Port Chester and New York, Westchester & Boston Railroads have been consolidated. An official statement says: "We have passed over the control of the New York, Westchester & Boston Railway Company to Oakleigh Thorne, president of the Trust Company of America, and Marsden J. Perry, of Providence, R. I. The same parties have also obtained control of the New York & Port Chester Railroad Company, which has been carrying on a bitter fight against the Westchester company for the last three years. Our firm will continue as syndicate managers, and will be properly represented in the management of the company." The weak point about the Westchester concern was its lack of franchises outside the City of New York. The Port Chester had franchises in nearly all the towns mentioned, but it was capitalized for only $250,000, whereas the Westchester's capital was $20,000,000, and in the financial district it was considered much the stronger of the two concerns. The Port Chester Company was the first in the field, coming into the city about three years ago with franchises from the smaller places sufficient to insure it a right of way to the State line. Then the Westchester company appeared, and opposed the granting of a franchise to the other company by the Board of Aldermen. For months there was a series of lively hearings. A little later the Westchester company obtained its franchise.

THE EASTERN CAHILL TELHARMONIC COMPANY, controlling the Cahill electric music system in the states of New York and New England, is now beginning its commercial operations for the distribution of music in New York City. Its central station and executive offices are at 39th Street and Broadway. The plant now installed is said to be capable of supplying music to twenty-five or thirty thousand ordinary reception rooms, such as are found in private houses, with a correspondingly less number of larger rooms. Any demand whatever can be met by increased capacity of dynamos just as is the case with electric light supply. The capitalization of the Eastern Cahill Telharmonic Company is $1,500,000 of preferred stock, with an equal amount of common stock. Its officers and directors are as follows: Oscar T. Crosby, president; Frederick C. Todd, vice-president; A. H. S. Post, treasurer; H. F. Stevenson, secretary; directors, Oscar T. Crosby, J. G. White, H. Carroll Brown, H. F. Stevenson, Frederick C. Todd, F. W. Lord, Charles McH. Howard, Edwin G. Baetjer and H. F. Audoun. The capital has been raised chiefly in Baltimore, Md. The invention originated in Washington, D. C., and Dr. Cahill for some few years past has been doing his experimental work at Holyoke, Mass.

CONSOLIDATION IN GEORGIA.—The street railway and electric light properties at Rome, Ga., have just been acquired by the Louisville, Ky., syndicate, represented by S. S. Bush, who is in charge of their properties also at Jackson, Tenn., and Pascagoula, Miss., as general manager, who has his office at the Columbia Trust Company, Louisville. The Rome properties have for a year past been undergoing re-building and extension, embracing new concrete power building, Curtis turbine, condensers, water tube boilers, super-heaters, economizers, Custodis stack, etc., and the extension of trackage to 8½ miles. It is the purpose of the new owners to increase the mileage so that they will have eleven miles in operation by spring, to duplicate all machinery at the new power plant and to remodel the old plant, which is in the center of the city, for car barn, shop, supply depot and offices; also to inaugurate a "new business" department for a big extension of light and power business. The company also acquired "Mobley Park" and the Driving Park and will develop these features with extensive changes. Rome and the suburbs reached by this system takes in a population of 25,000 and the city is showing a remarkable percentage of growth each year.

DIVIDENDS.—Directors of the Philadelphia Electric Company have declared the regular semi-annual dividend of 2½ (25 cents per share) on the paid-in value of the stock, payable December 15. Directors of the American Railways Company have declared the regular quarterly dividend of 1½ per cent, payable December 15. Directors of the Syracuse Lighting Company have declared the regular semi-annual dividend of ½ of 1 per cent on the common stock, payable December 1. Directors of the Kings County Electric Light & Power Company have declared a quarterly dividend of 2 per cent payable December 1. The directors of the Kansas City Railway & Light Company have declared the regular quarterly dividend of 1¼ per cent on the preferred stock, payable Dec. 1. The directors of the Columbus, O., Railway Company have declared the regular quarterly dividend of 1¼ per cent on the common stock, payable Dec. 1.

CINCINNATI CAPITALIZATION.—The directors of the Cincinnati Gas & Electric Company (recently leased to the Union Gas & Electric Company) have decided to increase the capital by issuing $1,400,000 of stock. This will be issued out of the $5,000,000 treasury stock. The increase is made necessary by the fact that the Cincinnati Gas & Electric Company had contracted for various improvements before the lease to the Union Gas & Electric Company had been consummated, and the lease provides that all improvements contracted for prior to the lease must be paid for by the Cincinnati Gas & Electric Company. The Union Gas & Electric Company of Cincinnati has given the General Electric Company a $300,000 contract for new dynamos.

TELEPHONE STOCK CONVERSION.—Advices from Portland, Me., of November 12, say: "The vote of a year ago, converting a part of the Northeastern Telephone Company's common stock into preferred and exchanging for a block of outstanding bonds a prescribed amount of the preferred stock, was rescinded at a special meeting of stockholders held this afternoon. The action has been opposed by the minority holders of common stock, and the Maine Supreme Court has granted a temporary injunction to restrain the directors of the company from carrying into effect the recorded vote. The company has an automatic telephone system in this city. A majority of the stock is held by Scranton, Pa., people, who constructed the local lines.

SOUTHERN NEW ENGLAND TELEPHONE.—The Southern New England Telephone Company directors have voted to stockholders of record November 15, 1906, new stock to the extent of 40 per cent of their holdings on that date, as a result of the recent vote at the special stockholders' meeting, which authorized an increase in the company's stock from $6,000,000 to $8,000,000. The company has $5,500,000 stock outstanding, and an increase of 40 per cent will mean $2,200,000 new stock, which will be offered at par. Subscriptions must be made before December 15, 1906, and payments are to be made in four equal installments, on January 15, April 15, July 15 and October 15, 1907.

IOWA CONSOLIDATION.—Announcement was made last week of the formation of the Tri-City Railway & Light Company, of Davenport, Iowa, to take over the light and traction interests of that city. At present these interests are held by eight companies, and it is planned to reduce these to three, these three in turn to be controlled by one corporation. The new company proposes to make certain reductions in traction fares and a reduction in the price of gas from $1.25 to $1.10 per thousand is announced. The holding company of the other corporations will be the Tri-City Railway & Light Company.

TELEPHONY IN BRAZIL.—The Telephone Company at Bahia, Brazil, hitherto the property of Sr. Pedro Caminha, has been sold to Messrs. Guinle & Co. for the sum of 400,000 milreis ($133,000 gold). The service is to be entirely renovated and a new central office erected. Guinle & Co. represent a number of American electrical interests.

GENERAL NEWS.

Construction News.

MOBILE, ALA.—The General Council on Nov. 15 has awarded to the Machinery Sales Company, of Cincinnati, Ohio, the contract for lighting the city for 10 years, beginning Nov. 1, 1907. The company agrees to furnish arc lamps for $58 per lamp per year, and to furnish electricity for light and power at a maximum rate of 8 cents per kw-hour; also to pay the city 2½ per cent of its gross receipts other than the city contract.

COTTER, ARK.—W. H. Standish, of Grand Forks, N. D., is interested in the construction of an electric light, power and railway system in this city.

CARMEL, CAL.—The Monterey County Gas & Electric Company is preparing to install an electric lighting system at Carmel-by-the-Sea.

BERKELEY, CAL.—Officials of the Oakland Traction Consolidated, which has obsorbed the Berkeley Traction Company, have announced that a new car line will be built in North Berkeley.

REDLANDS, CAL.—W. M. Campbell has petitioned the City Council on behalf of the Home Gas & Electric Company for a franchise to erect poles and string wires in this city. The company proposes to furnish electricity for power and lighting purposes.

VISALIA, CAL.—The new steam plant of the Mt. Whitney Power Company, located one-half mile east of here, has been officially tested and placed in operation. The plant will be used to relieve the two hydro-electric stations of the company which are located in the mountains.

HOLTON, CAL.—C. F. Paris has been appointed general superintendent of the Holton Power Company and Holton Interurban Railway, vice C. A. Howell, resigned. The general offices of this company will be located at El Centro in the near future. The ice plant will be rebuilt, and electrical installation will be more than doubled.

SAN FRANCISCO, CAL.—The Central California Power Company will hold a special stockholders' meeting in this city on December 27, to act upon a proposition to create a bonded indebtedness to the amount of $5,000,000, for the purpose of raising money to pay the indebtedness to be incurred in constructing and completing its power houses, transmission lines and other construction work, and for the purchase of lands and installations and equipments of all kinds, and for the payment of any debts or contracts for constructing, completing and equipping its plant for the production, transmission and sale of electric light, power and energy.

OROVILLE, CAL.—The Western Power Company has taken another step toward its permanent establishment as a merger of all the power companies in Upper California. A deed has been placed on record whereby the Great Western Power Company acquired from the Golden State Power Company possession of all its properties in Butte County. The consideration given in the deed is nominal. The land granted in the deed comprises 3,356.23 acres in the Big Bend country, and the instrument recites that the new company shall have possession of all of the water rights owned by the company on the Feather River, its tributaries and branches.

SAN FRANCISCO, CAL.—The Nevada Power Mining & Milling Company is planning to increase the capacity of its water power plant on Bishop Creek by an additional 1,500-kw unit, the increase being necessitated by the rapid growth of the company's business. The Allis-Chalmers Company will furnish the generator, which will be a three-phase, 60-cycle machine operating at 400 r.p.m. The water wheel of the tangential type will be supplied by the Abner Doble Company. The Schaw-Batcher Company will furnish the pipe, which will consist of 5,800 feet of 30-inch riveted steel pipe, connecting the station with a wooden stave pipe installed last year. This pipe line is designed to serve two 1,500-kw units under a head of 1,068 feet.

ASPEN, COL.—The Roaring Fork Electric Light & Power Company is contemplating the erection of a new hydro-electric plant of 1,500 hp and a three-phase transmission line 6 miles long.

SILVERTON, COL.—The municipal street lighting system is being extended and 14 new arc lamps installed. Benjamin Strong is superintendent.

FLORENCE, COL.—Mayor Fletcher has appointed a committee composed of Aldermen Beverstock and Parnell and City Attorney Blunt to investigate and report on the cost of erecting and operating a municipal electric light plant. The city owns a water system which can furnish power sufficient to generate more electric energy than is required to light and supply the domestic demand. The franchise of the Arkansas Valley Company will not expire for 12 years.

JULESBURG, COL.—Sealed bids will be received by the town clerk until Dec. 3 for the construction of an electric light plant and water works system. The specifications call for the construction of a power house, the installation of a direct-connected engine, 60-kw direct-current generator of 250 volts, one high-pressure boiler of 125 hp, one 50-hp, 250 volt electric motor, one two-stage six-inch centrifugal pump, car load electric light poles, 3 miles of wiring, 15 incandescent arc lamps, 220 volts, with hangings, and twenty 32-cp incandescent street lamps with brackets and fixtures. A. F. Perrier is town clerk.

CANON CITY, COL.—The Colorado Light & Power Company is making extensive additions and greatly increasing the capacity of its plant. An extension of 54x105 feet will be made to the boiler room, and to the engine room, 44x45 feet, and an addition, 27x40 feet, will also be made to the transformer room. Babcock & Wilcox boilers of 2,400 hp capacity will be installed, also an 850-kw Westinghouse-Parsons steam turbine unit and condensing apparatus of the Alberger Company. Provision is being made to install an additional unit of 850 kw when required. The present plant consists of three 500-kw units, direct connected to cross-compound engines.

NIANTIC, CONN.—A new industry about to start here is to install an electric light plant, and if enough subscribers can be secured to warrant it the company will furnish electricity for lighting in the village.

MERIDEN, CONN.—The H. L. Judd Company will soon install a large electric generator at its plant for the purpose of furnishing power with which to operate its works. It is intended to substitute electricity for steam.

WATERBURY, CONN.—The large power plant at Bulls Bridge, which furnishes the Connecticut Railway & Lighting Company with electrical energy, has closed again, owing to another break in the embankment. It will take about ten days to repair the damage. Electricity for operating the city lights will be furnished by the Scoville Manufacturing Company, of this city. The company will not be able to furnish electricity for commercial purposes until the plant is repaired.

RIDGEFIELD, CONN.—H. B. Anderson, promoter of the Ridgefield Electric Light Company, has furnished 50 incandescent lamps of 25 cp each for lighting the village since last August, free of charge, as an experiment, and for the purpose of creating a public sentiment which would secure the lamps permanently. Mr. Anderson offered to furnish fifty 25-cp incandescent lamps for $1,000 a year. At a meeting of the Burgesses of Ridgefield, held Nov. 10, it was voted not to accept the offer, and the village has since been in darkness. It is the general opinion that the decision of the board will be reversed after some agitation and that the streets will be again lighted.

WESTPORT, CONN.—The Westport Water Company has announced that hereafter a rebate of five per cent will be allowed on all electric lighting bills paid within ten days from date of bill. The company has under consideration the question of supplying a 24-hour electric light and power service. The company has recently been reorganized, and the new management is making arrangements to improve the service.

HARTFORD, CONN.—Changes are being made in the dynamos at the Berlin Power Station of the Consolidated Railway Company. Several of the large machines are being rewired. The station will furnish the energy for the electric service between Hartford and Rockville, it is said.

WILMINGTON, DEL.—The Smyrna, Kent County & Delaware Bay Traction Company has applied to the Levy Court for permission to lay tracks on the roads of New Castle County.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Dec. 4, to furnish at the navy yards, etc., Portsmouth, N. H.; Boston, Mass.; Newport, R. I.; New York, N. Y.; League Island, Pa.; Annapolis, Md.; Washington, D. C.; Norfolk, Va., and Charleston, S. C., a quantity of naval supplies as follows: Schedule 260—Rewiring building, etc. Schedule 261—Electric cable, incandescent lamps, electrical supplies, air drills and twist drills, electric wagon, etc. Applications for proposals should designate the schedules desired by number. E. B. Rogers, Paymaster-General, U. S. N.

FORT MYERS, FLA.—The Seminole Power & Ice Company is contemplating the construction of an electric railway from Fort Myers to Fort Thompson.

PELHAM, GA.—The Mayor writes that it is proposed to construct water works and an electric light plant, at a cost of $40,000. An engineer has not yet been selected.

MISSION RIDGE, GA.—The Mission Ridge Clay Company has awarded the contract for installing an electric lighting plant in its works here to the Connally-McIlheran Electric Engineering Company.

FORT VALLEY, GA.—The question of installing an electric motor in the city light and water plant next year for pumping the city water is now being considered. J. L. Fincher is superintendent.

BAINBRIDGE, GA.—The capacity of the municipal electric light plant is being increased to provide for a day service. An 80-kw, Stanley-G. I., two-phase generator, with a 125-hp Corliss engine and a boiler of 150 hp, are now being installed in the plant. L. L. Ingram is superintendent.

ROME, GA.—The street railway system and electric light plant owned by the City Electric Railway Company, has been purchased by the Louisville, Ky., Syndicate, represented by S. S. Bush. The company has recently made extensive additions and improvements to street railway system and power plant, including a new power house with a Curtis turbine, condensers, water tube boilers, etc. The new owners propose to further extend the street railway line, so as to have 11 miles in operation by spring, and to duplicate all machinery at the new power plant and to remodel the old plant for car barn, shop, supply depot and offices; also to inaugurate a new business department for the extension of its light and power business.

LEWISTON, IDAHO.—Bids will be received until Dec. 3 by John E. Nickerson, city clerk, for furnishing a vertical triplex power pump and electric motor, etc. Address C. N. Miller, engineer in charge of the water works.

FIELDON, ILL.—The Western Telephone Company has increased its capital stock from $960 to $1,960.

CHICAGO, ILL.—The Aurora & Chicago Railroad is contemplating the extension of its line from Hinsdale to Melrose Park or Maywood.

GARRETT, IND.—The citizens are contemplating the installation of a 300-hp engine in the city water and light plant. G. C. Scott is superintendent.

MITCHELL, IND.—The old open-arc lamps of the municipal electric system have been replaced by new enclosed-arc lamps. H. S. Kelly is superintendent.

KOKOMO, IND.—The City Council has adopted a resolution declaring the franchise of the Kokomo Gas & Light Company forfeited and that the corporation is a trespasser in the streets. The Council is holding out inducements to any competitive company wishing to occupy the field for light and power purposes.

TERRE HAUTE, IND.—The Board of Public Works has refused to grant a franchise to the Rush Hydraulic Company, which is proposing to supply the cities of Southeastern Indiana with electric light and power from a water power plant to be built on White River. The refusal is based on the ground that the city does not deem it advisable to contract for street lighting so far in advance of the completion of the plant.

INDIANAPOLIS, IND.—The Indianapolis Light & Heat Company is preparing to manufacture and use concrete poles. The company managers say they have made every effort to place their new arc lamps, but cannot do so because of the inability to secure wooden poles.

ARDMORE, I. T.—The Ardmore Light & Power Company will soon construct a street railway system in this city, for which it was recently granted a franchise.

MASON CITY, IA.—The Peoples Electric & Gas Company is contemplating changing the city lighting system from direct to alternating-current.

OSKALOOSA, IA.—The Oskaloosa & Buxton Interurban Company has purchased the electric light plant and street railway system of the Oskaloosa Traction & Light Company for $95,000.

MUSCATINE, IA.—The Child, Hulswith Company, of Grand Rapids, Mich., has purchased the plant and street railway system of the Citizens' Railway & Light Company, of this city. A. L. Lindner is manager.

WICHITA, KAN.—Plans are being made by the owners of the Wichita Railroad & Light Company for the immediate construction of the interurban line connecting the cities of Wellington and Arkansas City with Wichita.

MADISONVILLE, KY.—Plans are being made for the erection of a new lighting plant in this place.

FRANKFORT, KY.—The State Prison Commission on Nov. 12 awarded to Joseph McWilliams & Company, of Louisville, the contract to install an electric power plant in the State penitentiary for $14,200.

CARROLLTON, KY.—Bids will be received until Dec. 5 by William G. Schuerman, Mayor, for $25,000 bonds, to be issued for the purpose of purchasing, repairing and improving the electric light plant, repairing and improving the water plants, etc.

FRANKFORT, KY.—Bids will be received until Dec. 4 by the State Board Capitol Commissioners (Henry B. Ware, secretary) for ventilating and heating apparatus, electric wiring, conduit, annunciator and bell service, etc., and electric passenger elevators, for the Kentucky State Capitol building, now in course of erection. Frank M. Andrews, 25 East Third Street, Cincinnati, O., is the architect.

NEW IBERIA, LA.—W. P. Connery, of New Orleans, promoter of the City Electric Railway, and representing the Bayou Teche Electric Light and Railway Company, has submitted to the City Council a proposition to buy the municipal electric light and water works plant. He agrees to assume the unpaid indebtedness of the plant, which is said to amount to about $44,000 and to furnish the city with 2,000-cp arc lamps at a rate of 85 cents per night per light and subtract 50 cents for each hour that the arcs are not burning. He also agrees to furnish electricity for commercial lighting at a rate of 12 cents per kw-hour.

BELFAST, ME.—The Belfast Gas & Electric Company is preparing to install a new water wheel in its plant at East Belfast.

PRESQUE ISLE, ME.—The Maine & New Brunswick Electrical Power Company, which is developing a water power at Aroostook Falls, N. B., has placed a contract for its water power equipment with the Jenckes Machine Company, of Sherbrooke, Que. Two units of 900 hp each will be installed, consisting of a pair of special 21-inch cylinder gate Crocker turbines, running at 600 r.p.m. under a 72-inch head. Each unit will be direct-connected to a generator, the order for which has been placed with the General Electric Company.

ANNAPOLIS, MD.—The Chesapeake & Potomac Telephone Company proposes to submit to the Council an ordinance asking the use of certain city streets in Annapolis for the laying of conduits.

BALTIMORE, MD.—The Chesapeake & Potomac Telephone Company has made arrangements to increase the equipment of its Madison, Gilmor and Wolfe exchanges, at an expenditure of $275,000, in addition to an enlargement of the Madison Exchange, on Madison Avenue, north of Robert Street. The equipment at the Madison Exchange now accommodates 4,000 telephones, and arrangements will be made to accommodate 16,000.

PITTSFIELD, MASS.—The Berkshire Street Railway Company has filed a petition with the Secretary of State, asking that the Legislature give it authority to sell electricity to the Stockbridge Electric Light & Power Company.

BOSTON, MASS.—The Boston & Northern Street Railway Company has petitioned the Railroad Commissioners for their approval of an issue of $300,000 new stock for the purpose of providing means to pay for additional rolling stock and equipment.

PLYMOUTH, MASS.—The Plymouth Electric Light Company is installing an 80-kw alternating-current General Electric generator to provide for its increasing business. The machine will be connected to a 120-hp Ide engine. E. P. Rowell is superintendent.

BOSTON, MASS.—The Boston Elevated Railway Company, controlling all the trolley lines in Boston and vicinity, and also the elevated system, announces that an increase in wages will be made on Jan. 1. The increase will average 10 cents a day for the 5,300 employes.

DANVERS, MASS.—Owing to the burning out of a 130-kw dynamo in the municipal electric lighting plant, a large part of the commercial lighting service has been put out of commission. It is expected that a special town meeting will soon be called to take action regarding additional equipment for the plant.

WEST HANOVER, MASS.—The Electric Light & Power Company, of North Abington, has been granted a franchise to extend its line to the Hanson line on King Street and to the junction of Cedar Street on Pleasant Street. The town has not yet contracted for light, though the Selectmen have made arrangements to have the square and station lighted.

BENTON, MICH.—The Michigan Telephone Company has accepted the new franchise passed by the Council, and agrees to put in an entire new plant in this city.

PELLSTON, MICH.—The Pellston Electric Company is contemplating extending its transmission line from Mackinaw to Petosky, a distance of 36 miles, and will furnish electricity for lighting and power in all the towns between the two cities. F. E. Hatch is manager.

PONTIAC, MICH.—The Council is considering cancelling the contract of the Standard Lighting Company for street lighting. The contract is said to call for commercial lighting also, which is not being given. The Standard claims it cannot interest capital because of a clause giving the city the option of buying in five years.

ANN ARBOR, MICH.—The Washtenaw Light & Power Company of this place has completed the purchase of the water rights of the Ypsilanti Paper Company, at Lowell, and will put in an electric lighting and power plant at that place. The company has recently secured a franchise for lighting the village of Saline, and 20 street lamps will be installed there. The electric power will be transmitted from the Gedded plant, a distance of nine miles.

HOLLY, MICH.—Chas. H. Bird has secured an option on the Holly Milling Company, which includes an electric light plant. The option covers the entire property and it is proposed to put the mill in operation at an early date and run it in connection with the lighting and water pumping plant, providing the promoters can secure the required franchises from the village. A 10-year contract is asked with the village for 40 lamps at $60 a year each, commercial lighting, 12 cents per kw-hour, and a one-year contract for pumping the city water for $2,500.

BIWABIK, MINN.—Bonds for the water and light plant have been sold.

CROOKSTON, MINN.—A. M. Childs, city clerk, writes that it is not proposed to construct a municipal electric light plant at Crookston.

NORTHFIELD, MINN.—A special election will be held on Jan. 8 to decide whether to bond the city for $35,000 for the purpose of installing a municipal telephone exchange.

CHISHOLM, MINN.—The Chisholm Light & Power Company is having surveys made for the construction of a dam on the Sturgeon River, 12 miles from Chisholm, where 1,200 hp will be developed. The equipment of the power house will consist of two 500-hp turbines and two 300-kw, 1,100-volt, three-phase generators. The transmission will be at 22,000 volts. D. D. Crowley, 301 West Michigan Street, Duluth, is president and manager.

JACKSON, MISS.—The question of placing all overhead wires in underground conduits is now being agitated in this city.

McCOMB, MISS.—The McComb City Electric Light & Power Company will build a new power house soon, but will not add to the present capacity of the plant for some time. A. H. Jones is manager.

MAGNOLIA, MISS.—The Magnolia Electric Light Company and the City Council have reached an agreement for lighting the streets. The new rate is an increase of about 20 per cent above the old rate. Owing to a disagreement in regard to the rates the city has been without street lights for nearly two months.

ST. JOSEPH, MO.—The Citizens Telephone Company has increased its capital stock from $150,000 to $1,000,000.

ALBA, MO.—G. C. Adams and E. W. Hesser, of Carthage, have secured a franchise for an electric light plant at Alba.

ST. LOUIS, MO.—A meeting of the stockholders of the Emerson Electric Manufacturing Company will be held here Jan. 7 for the purpose of increasing the capital stock of the company from $300,000 to $600,000.

ST. LOUIS, MO.—The St. Louis County Court has granted the petition of the St. Louis, Fern Ridge & Western Railway for a franchise to lay a track on Etzel Avenue from the city limits to the terminus of the avenue.

EXCELSIOR SPRINGS, MO.—The capacity of the electric light plant is to be doubled. A new Allis-Chalmers unit of 150 kw capacity will be installed. When it is in operation a 24-hour service will be inaugurated.

RICHMOND, MO.—The Missouri Electric Light Company is installing a new alternating-current dynamo in its plant. J. M. Ferguson is president and manager.

WAUNETA, NEB.—G. C. Athey contemplates the erection of an electric light plant here.

McCOOL JUNCTION, NEB.—The Town Board has passed an ordinance granting to Clark R. Burnham, of Grand Island, Neb., a franchise to maintain and operate an electric light and power plant and a system of water works.

OMAHA, NEB.—The Omaha Electric Light & Power Company is replacing its old boilers with four Stirling boilers of 550 hp each. Following the recent explosion at the power plant which cast the city in darkness and has caused poor lighting since, the company is now making extensive improvements and increasing the capacity of the plant.

SILVER PEAK, NEV.—The Nevada & Alpine Electrical Company is installing electrical machinery in the Nevada Alpine mine and the Alcade mine for operating these properties by electricity.

MT. HOLLY, N. J.—Bids will be received by the Township Committee until Dec. 18 for furnishing, operating and maintaining not less than 12 arc lamps of 5 amps. at 110 volts or their equivalent, and not less than 200 incandescent lamps of 20 cp for lighting the streets of Northampton Township for 1, 3 and 5 years, after April 1, 1907. Harry Hawkins, Jr., is town clerk.

ORANGE, N. J.—Contracts for constructing the municipal electric light plant have been awarded as follows: For generators, engines, switchboards and 350 standard-arc lamps to the Crocker-Wheeler Company, of Ampere, N. J., for $33,047. The generators are to be of the Crocker-Wheeler type and the engines the Ball & Wood compound style. The Western Electric Company, of New York, N. Y., was given the contract for poles and line equipment at $17,400. In addition to this there will be required a building of concrete, foundations, smoke stack and three boilers, which will be constructed by the Water Department, in conjunction with the sewer pumping station, and with which the lighting plant is to be operated.

BROOKLYN, N. Y.—C. B. J. Snyder, superintendent of school buildings, New York City, has awarded the contract for electric equipment in School 30 to T. Fred Jackson, Inc., 592 Columbus Avenue, for $7,500. The Commercial Construction Company, New York, secured the contract for installing electric equipment in School 8 for $7,832. Bids will be received until Nov. 26 by C. B. J. Snyder, superintendent school buildings, New York City, for installing electric equipment in new School 114, Canarsie.

KREICHERSVILLE, S. I., N. Y.—Bids will be received until Nov. 26 by C. B. J. Snyder, superintendent school buildings, New York City, for installing electric equipment in additions to and alterations in School 4, Kreichersville, Borough of Richmond.

MORAVIA, N. Y.—The Moravia Electric Company is contemplating the reconstruction of its transmission line. Silas Taber is secretary and manager.

MONROE, N. Y.—The new plant of the Orange & Rockland Electric Company is nearly completed and will soon be in operation. R. W. Smith is president and manager.

ROCHESTER, N. Y.—The Rochester Railway & Light Company has applied for permission to construct an electric power station near the Lower Falls on Hastings Street, to cost $57,000.

FAIRPORT, N. Y.—The citizens are now considering the question of a continuous service by the municipal electric light plant. Under the present arrangements the service is shut off at 11 o'clock at night.

NORWICH, N. Y.—The Norwich Gas & Electric Company contemplates extensive additions and improvements to its plant, and will install entirely new equipment, with the exception of boilers. T. W. Summers is secretary and manager.

COLONIE, N. Y.—The Ludlum Steel & Spring Company, now building a factory in Colonie, near Menands, has entered into a contract with the Hudson River Electric Company for 2,000 hp. The factory will be operated by electricity when completed.

BUFFALO, N. Y.—A certificate of necessity has been issued by the State Railroad Commission to the Frontier Electric Railroad, which is to be a new line of the International Railway Company, operating over its own right of way from this city to Niagara Falls.

COLDSPRING HARBOR, N. Y.—The citizens are agitating a lighting district here, and it is probable that an application will be made at once to the town board for the same. At the present a few lamps are in use, but the citizens desire an electric lighting service.

THERESA, N. Y.—The new municipal electric lighting plant has been put in operation and is giving satisfaction. The plant has a capacity of 175 hp, which will provide for all present needs, including the pumping of the village water. The plant when fully equipped will have a capacity of 450 hp. At present the street lighting system consists of 26 Adams-Bagnall arc lamps of 1,500 cp each. It is expected that more lamps will be provided in the near future. William Harder is superintendent.

MIDDLEVILLE, N. Y.—The Middleville Electric Light Company has been granted consent by the Commission of Gas and Electricity to increase its capital stock from $4,000 to $12,000, the increase to be used for the purpose of the further development of the plant. The capacity will be increased to 120 hp. The company furnishes electricity for light only now, but will be able to supply energy for power when the improvements are completed. David E. Ford is the president and general manager. Lewis H. Goodman, secretary and treasurer, and A. M. Goodman, vice-president.

CANASTOTA, N. Y.—Bids for lighting this village were opened by the Board of Trustees on Nov. 7. There were but two bidders, the Empire State Power Company and the Central New York Company, of Utica. Bids were received for a two-year and a five-year proposition, the lamps to burn until 1 a. m., moonlight schedule. The bid of the Central New York Company was the lower; its prices for street lamps were $45 per year on the two-year contract and $35 per year on the five-year contract. The total per year on the two-year contract was $3,874, and on the five-year contract, $3,146. The bids of the Empire State Power Company were $4,283 for a two-years' contract and $4,490 for a five-years' contract.

SYRACUSE, N. Y.—An ordinance was adopted by the Common Council at a recent meeting directing the Comptroller to audit the Lighting Company claims for street lighting at the rate of $68 a lamp per year hereafter and dating back to March 31. This temporarily settles the company's demands on the basis of the rate fixed by the Gas Commission and a stipulation ordered by the Appellate division when the case came up on appeal. It involves an additional payment of $2,362.50 to the Lighting Company to what has already been paid since March 31 last, minus rebates for lamps out. The lighting company's contract expired March 31 last and since then it has been lighting the streets under a stipulation with the city for payments on a basis of $65 per lamp per year. This stipulation provided that the difference, one way or the other, for the service should be paid on the termination of the case by one party or the other as the case might be.

SANFORD, N. C.—The Buckhorn Power Company has been granted a franchise in this town. The company is under contract to furnish electricity for lighting by Dec. 20, and electric energy for manufacturing purposes is to be available by July, 1907.

CHARLOTTE, N. C.—The Southern Power Company, of Charlotte, will soon commence work on the construction of two new power plants, one at Ninety-nine Islands on Broad River, 6 miles south of Blacksburg, to produce 16,000 hp, the other at Rock Creek, 2 miles below the Great Falls Station on Catawba River, to produce 30,000 hp. The total cost of work is placed at $3,000,000. W. S. Lee, Jr., is chief engineer.

COOPERSTOWN, N. D.—The Griggs County Telephone Company has purchased the local telephone exchange and will make improvements to the system.

PORTSMOUTH, OHIO.—The Portsmouth Telephone Company has increased its capital stock from $100,000 to $200,000.

SPRINGFIELD, OHIO.—The Peoples Light, Heat & Power Company has decided to enlarge its plant. Charles S. Kay is general manager.

STEUBENVILLE, OHIO.—The Phoenix Telephone Company has petitioned for a franchise to place conduits in certain streets of the city.

COLUMBUS, OHIO.—The City Council has decided to issue $140,000 in bonds for repairs and extensions to the municipal electric light plant.

MT. VERNON, OHIO.—The Mt. Vernon Telephone Company has increased its capital stock from $150,000 to $250,000. Frank L. Beam is president.

LANCASTER, OHIO.—The Ohio Central Railway Company has petitioned for a franchise to operate a street railway on certain streets of this city.

COLUMBUS, OHIO.—The Home Mixture Guano Company has placed an order for a complete electric power plant for its works to be installed and in operation by the first of the year.

CINCINNATI, OHIO.—Bids will be received until Nov. 26 by the Board of Public Safety, for the manufacture and delivery of underground alloy-covered cables for the electric and telephone circuits of the Cincinnati fire alarm system. J. A. Mulvihill is secretary.

TROY, OHIO.—The municipal electric light plant has recently replaced the old open-arc lamps with the Western Electric system of enclosed-arc lamps and has also installed a 150-kw Western Electric 60-cycle generator in the plant. L. A. Pool is superintendent.

RAVENNA, OHIO.—Application has been made to the City Council for a franchise through this city by the Akron & Youngstown Electric Railway, of which Thomas W. Childs is chief promoter. The road will be practically an air line, and will be built on private right of way.

AKRON, OHIO.—A reduction of 50 per cent has been made in the charges for lighting service by the Northern Ohio Traction & Light Company in competition with the gas companies here. In addition, a discount from bills will be allowed in case they are paid by a certain time each month, and it is said that this will bring the reduction to 67 per cent. Additions have been made to the plant sufficient to take care of the new business that is expected from this offer. Residents of Barberton will also enjoy the benefit of a reduction.

COLUMBUS, OHIO.—At a meeting of stockholders of the Gold Mine & Power Company, of Colorado, held recently, the following directors were chosen: L. D. Bonebrake, Cyrus Huling, D. C. Doney and C. E. Bonebrake, all of Columbus; Isaac D. Smead, of Cincinnati; E. C. Condit, of Eureka, Col., and J. H. Cook, of Kansas City. A bond issue of $500,000 was authorized on the property now owned by the company, which was incorporated with a capital stock of $1,500,000. The company will erect a hydro-electric plant to operate its mines and others in the vicinity. The plant will be located in San Juan County, a few miles southeast of Silverton.

GUTHRIE, OKLA.—Reynolds & Tucker, of Tulsa, have secured a franchise for an electric light plant.

CLINTON, OKLA.—E. Humphrey, D. N. Bolton and T. J. Name have been appointed as a committee to procure plans and specifications for constructing water works and an electric light plant.

OKLAHOMA CITY, OKLA.—On account of the rapid growth of the city the present electrical machinery at the electric light plant is hardly adequate to handle the business. The company recently placed an order for a large engine, which it is hoped to have installed by the first of the year.

SILVERTON, ORE.—The subject of municipal ownership of the electric light plant is being strongly agitated in this city at the present time and it is expected that the City Council will take steps to build and maintain a plant in the near future.

GRANITE, ORE.—The Fremont Power Company is installing an electric power plant at Granite, Ore., the power for which is generated from Olive Lake and Lost Creek. Olive Lake, about 12 miles west of Granite, covering a little over 100 acres, has been chosen as a reservoir in which to store water. From the reservoir the water is to be conveyed through 34-inch pipe, which is about six miles in length, to the power house. The power house is built of concrete blocks. Three 100-kw generators will be installed, connected to the Pelton wheel. The power house is on Congo Creek, about two miles above the Red Boy mine. A power transmission line is being constructed from the power house to Bourne, a distance of 20 miles.

WAYCROSS, PA.—The new plant of the Bailey Manufacturing Company will be operated entirely by electricity.

BELLEFONTE, PA.—The Bellefonte Electric Company contemplates the installation of another unit of 100 kw and the extension of its lines. F. R. Bussler is superintendent.

CHAMBERSBURG, PA.—The Borough Council on Nov. 9 awarded to the Buckeye Electric Company the contract for one year for furnishing grade A lamps at 12½ cents apiece.

LIGONIER, PA.—The Ligonier Electric Light Company is contemplating the installation of a new generator and engine in its electric light plant. John Andrews, Jr., is manager.

NORRISTOWN, PA.—Because the ballots on the proposition of the borough of Pennsburg to borrow $15,000 to establish an electric lighting plant were not returned to court the day after election, the vote is declared invalid.

WAYNESBORO, PA.—The City Council has authorized the street committee to enter into a five-year contract with the Waynesboro Electric Light & Power Company for lighting the borough at $88 per arc lamp per year. The price paid on the former contract was $92 per year.

TELFORD, PA.—The West Telford Electric Light & Power Company has been awarded the contract for lighting the borough of Telford and West Telford with 26 arc lamps at $30 per year to burn until midnight on moonlight schedule. Morris A. Clymer is secretary and manager.

SUNBURY, PA.—It is now stated that the parties interested in the Wilkesbarre & Hazleton Electric Railway will build a new line between Wilkesbarre and this place, purchasing the right of way of the Danville & Sunbury Company, and running the line via Empire, Nanticoke and Danville.

ALLEGHENY, PA.—At the next meeting of Select Council an ordinance will be presented calling for additional arc lamps in all the outlying or rural districts of Allegheny, as the city light plant has all it can do to supply the present needs. The ordinance will permit of the officials making contracts with independent light companies for obtaining, if necessary, additional energy.

WILKESBARRE, PA.—It is reported that arrangements have been made by the Parsons Electric Light Company with the Wilkesbarre Gas & Electric Company to furnish electricity for operating the electric lighting systems throughout Plains, Miners Mills and Parsons, the plant of the former company being unable to supply the demand. The Wilkesbarre Gas & Electric Company will be compelled to install new transformers, as the present equipment is already taxed to the limit. New generators will be placed at the plant, situated just over the city line near the Prospect Colliery, of the Lehigh Valley Coal Company. The Parsons Company also has many alterations to make before the final change. The plant at Parsons will not be used until a new one is erected.

CAMDEN, S. C.—The new plant of the Camden Water, Light & Ice Company is nearly completed, and the city will soon be lighted by electricity again. After the plant was destroyed last July the company secured power from the Cotton Seed Oil mill, but when the mill started up in September the energy was turned off, and the city has since been without electric light.

PIERRE, S. D.—The question of constructing an electric light plant is under consideration.

WESSINGTON SPRINGS, S. D.—R. A. Bushnell is interested in the construction of an electric light plant here.

UNION CITY, TENN.—Extensive alterations and improvements are being made at the city water and light plant.

PARIS, TENN.—The city is considering the question of installing a 300-hp engine in the municipal electric light and water plant. E. R. Lee is chief engineer.

NASHVILLE, TENN.—The stockholders of the Nashville Railway & Light Company have unanimously approved the proposition authorizing a new bond issue of $15,000,000. The stockholders also voted to sell $1,000,000 treasury stock.

WATERTOWN, TENN.—The Watertown Electric Light & Power Company, which is to erect an electric light and power plant in this place, has placed orders for the equipment of its plant. A 75-hp Corliss engine, 60-kw generator and a water tube boiler of 100 hp will be installed. A large wood-working plant will be installed and operated in connection with the plant. W. L. Goddard is president.

MEMPHIS, TENN.—Bids will be received until Dec. 6 at the office of Ennis M. Douglas, City Register, for the following work on the elevator at the City Hospital: Alternating-current, 60-cycle; also for 500-volt, direct-current equipment, this equipment to replace present 500-volt, direct-current equipment now in service (Central Iron Works and Westinghouse Motor). Present cable guides and counter-weights and such cable as will be suitable for the new equipment will be used.

WAXAHACHIE, TEX.—A franchise has been granted by the City Council to the Central Texas Traction Company, of Dallas.

MARFA, TEX.—A company has been organized in this place, with a capital stock of $20,000, to construct an electric light, ice and telephone plant. Orders for the machinery have already been placed.

PALESTINE, TEX.—G. W. Burnett, president Palestine Electric Light Company, writes that bids will be received on Nov. 26 for the construction of an electric light plant to cost $40,000. James F. Brown is the engineer.

MARSHALL, TEX.—The Arkansas & Texas Consolidated Ice & Coal Company is making extensive improvements and increasing the capacity of its plant. The system is being changed from single to three phase, and the frequency from 125 to 60 cycles. E. L. Welch, Jr., is manager.

HOUSTON, TEX.—The Houston Light & Power Company is contemplating improvements to its plant, at a cost of about $125,000, which will double the present capacity. The brick power house on Buffalo Bayou is to be increased one-fourth its present size; a new turbine engine is to be installed and other additional machinery. W. H. Chapman is manager.

SALT LAKE CITY, UTAH.—The South Jordan Canal Company has made application to the State Engineer to appropriate water for power purposes. A plant will be erected, at a cost of about $15,000. Angus M. Cannon is president.

RICHFIELD, UTAH.—The Richfield Electric Light & Power Company has commenced work on its plant in Glenwood, to connect with this city. Survey for the transmission line has started and the machinery purchased. The steam plant in the city will be maintained as an auxiliary plant, to assist the other when necessary. New generators will be installed in the steam plant.

ATLANTIC CITY, VA.—The Atlantic City Electric Company has been incorporated with a capital stock of $50,000.

RICHMOND, VA.—The Henrico Railway Company has applied to the Corporation Commission for a charter and proposes to take over the Citizens' Rapid Transit Company and extend the system. The capital stock will be $10,000. W. S. Forbes is president, W. W. Jenkins, vice-president, and John C. Hagin, secretary and treasurer.

RADFORD, VA.—The Radford Water Power Company, which operates the electric lighting plant, street railway system and the water works in this city, has been purchased by J. L. Vaughan, of Shawsville. Extensive improvements are contemplated in the near future. The power house will be improved, new cars purchased and new motors placed at East Radford. The electric car line will be extended to the fair grounds next spring.

SEATTLE, WASH.—The Seattle Electric Company has secured permits at Georgetown, near Seattle, for the construction of the new buildings in connection with new power plant which the company is to erect at a cost of approximately $1,000,000. The permits are for five buildings, to cost $92,000.

SPOKANE, WASH.—Surveys are now under way and work will start within 30 to 60 days on the proposed power plant of the Big Bend Water Power Company. Contracts will shortly be let for the power plant, which will cost $750,000; it is also proposed to expend $50,000 on a transmission line to the Coeur d'Alene district. E. P. Spalding, of Wallace, Idaho, is general manager.

TACOMA, WASH.—Bids submitted by the Tacoma Railway & Power Company and the Seattle-Tacoma Power Company for furnishing electricity for the municipal electric light plant for a term of five years, were exactly the same, the price being 1¼ cents per kw-hour. The City Council is about to ask bids for the installation of an electric plant to generate current for lighting the city. H. J. Fuller, special engineer for the city, recommends the adoption of a producer gas plant having an equipment of 5,000 hp, to cost approximately $500,000.

BURLINGTON, W. VA.—The Chesapeake & Potomac Telephone Company has transferred its interests in the section about Keyser, W. Va., to the Burlington Telephone Company, in which George P. Shank, of Mineral County, is interested. The Burlington system will make numerous improvements and a new central station will be put in at Burlington.

MILWAUKEE, WIS.—Kroeger Brothers have secured a site on Second Avenue, on which the firm contemplate the erection of a warehouse and a lighting and heating plant.

WASHBURN, WIS.—The City Council has decided to erect a municipal electric light plant in this city.

SULLIVAN, WIS.—The Sullivan Telephone Company has been incorporated, with a capital stock of $10,000, by W. E. Blumenstein and others.

BEAVER DAM, WIS.—A new boiler of 150 hp is now being installed in the plant of the Beaver Dam Illuminating Company. Frank Askew is superintendent.

MILWAUKEE, WIS.—An advisory committee has been appointed by President Adam Meisenheimer, of the Common Council, to consult with the Board of Public Works on the proposed municipal electric light plant. The committee consists of Francis J. Stiglbauer, Sebastian Walter, Henry Smith, George J. C. Steffen and H. W. Grantz.

MILWAUKEE, WIS.—The Common Council on Nov. 12 passed an ordinance giving the Milwaukee Independent Telephone Company permission to maintain a telephone system in the city of Milwaukee. Work on the construction of the plant will be started as soon as the organization of the company is completed. H. D. Critchfield, of Buffalo, N. Y., is president.

MANAWA, WIS.—The Little Wolf River Electric Company has recently purchased a direct-current, 220-volt Northern Electric generator having a capacity of 100 kw for its lighting plant. The company has been awarded the contract for street lighting for a term of two years. The contract calls for 30 incandescent lamps of 16 cp at $7.20 per lamp per year. Arthur Lindsay is manager.

VERMILION, CAN.—The Alberta Power & Light Company is seeking incorporation for the purpose of supplying this and other towns with electricity for light, heat, power and telephone purposes and to carry on a general business as electricians and to deal in and manufacture all kinds of electrical appliances. H. V. Fieldhouse, Vermilion, Sask., Canado, is interested.

JACKFISH, MAN.—The power house of the Canadian Pacific Railroad Company coal docks was recently destroyed by fire.

OTTAWA, ONT.—The Council has passed a by-law providing for the issue of $50,000 bonds for the extension of the electric light plant.

KINGSVILLE, ONT.—The Windsor, Essex & Lake Shore Electric Railroad, of Windsor, Ont., has decided to build a new power house in this place.

GRAVENHURST, ONT.—The ratepayers of this town will vote on a bylaw to raise $45,000 for the establishment of an hydro-electric power plant at South Falls and transmission line to this town.

CHAUDIERE, QUE.—It is stated that the General Electric Company of Schenectady, N. Y., has decided to erect a mica factory in this town. There are mica mines in this locality.

MONTREAL, QUE.—A charter has been granted to the Grosvenor Light, Heat & Power Company to sell electricity for light and power in this city. H. M. Marler is one of the incorporators.

MONTREAL, QUE.—The Saraguay Electric Company has made application to the city for the right to sell electricity for light and power in Montreal. The company is now furnishing electricity to the villages of St. Laurent, Cartierville and Boreaux. E. Champagne is managing director.

OAXACA, MEX.—The Government of the State of Oaxaca has awarded contracts for the installation of electric lighting plants in the towns of Tehuantepec and Juchitan. The terms of the contract require that both plants shall be completed and in practical operation by the first day of December, 1907.

PUEBLA, MEX.—Compania Limitada de Luz y Fuerza Motriz de Puebla has been organized here, with a capital stock of $6,000,000, for the purpose of constructing an extensive system of electric street railway and interurban lines. The State and municipal governments have granted the company valuable concessions, including franchise rights to use the principal streets of the city.

MEXICO CITY, MEX.—The Mexican Light & Power Company, the Canadian concern which owns the electric power and transmission plant at Necaxa and the lighting system of this city, as well as extensive transmission lines, has added to its large holdings by purchasing the electric lighting plants of the Compania Electrica Robert, S. A. The latter company provided the suburban towns of Tlalpam, San Angel, Coyoacan, San Pedro, Mixcoac and Tacabaya with electric lights. The price which the Mexican Light & Power Company paid for the property was $700,000 cash. The acquired lighting system will be consolidated with the Mexico City system later on. R. F. Hayward, general manager of the Mexican Light & Power Company, has appointed W. N. Parsons general manager of the acquired system. Mr. Parsons' jurisdiction also extends to the company's lighting system in Churubusco and all the Federal district south of Mexico City.

New Industrial Companies.

THE ELECTRICAL ALARM COMPANY, of Spokane, Wash., has been incorporated, with a capital stock of $10,000, by J. D. Calhoun, E. B. Simmins and M. L. Grose.

THE ELECTRIC FLOOR SURFACER COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $10,000. The directors are G. F. Hall, of Providence, R. I.; E. F. Murdock and H. L. Murdock.

THE WALSH GOVERNOR COMPANY, of La Porte, Ind., has incorporated with a capital stock of $40,000, to manufacture the Walsh governor, and other machinery. Charles N. Walsh, William N. Rumley and A. J. Rumley are the directors.

THE WILLIAMS ELECTRIC VEHICLE COMPANY, of Cleveland, Ohio, has filed articles of incorporation, with a capital stock of $500,000. The incorporators are Harry A. Williams, George Haas, J. E. Vail, G. H. Rempes and J. C. Sims.

THE BURD-HOWARD ENGINEERING & CONSTRUCTION COMPANY, of St. Louis, Mo., has applied for articles of incorporation. The incorporators are: Isaiah W. Newcomer; John N. Carswell, of Philadelphia, Pa.; Trent Becraft, Charles Morsey and T. J. Franks, of St. Louis. The object of the company is to construct and equip steam and electric railways, water and gas works and to a general contracting business. The capital stock is $10,000.

New Incorporations.

GADSDEN, ALA.—The Little River Power Company has filed articles of incorporation with a capital stock of $100,000 for the purpose of developing electric power on Little River, near Blanch, Ala., for light, heat and power. The principal offices will be in this city. It is stated that 20,000 hp can be developed at the proposed plant. The stockholders of the company are: R. A. Mitchell, of Alabama City; O. R. Goldman, of Gadsden; H. P. Henderson, of Durango; Col. H. W. Sexton, of Anniston, and Fernwood Mitchell, of Birmingham.

OAKLAND, CAL.—The Berkeley Traction Company has filed articles of incorporation, with a capital stock of $200,000. The incorporators are Louis Titus, Walter H. Leimert, Duncan McDuffie, P. T. Tompkins and C. C. Young. The company is an adjunct of the Oakland Traction Consolidated.

NAPA, CAL.—Articles of incorporation have been filed for the Vallejo & Northern Railroad Company for the purpose of building an electric railway from Woodland to San Francisco. The road will be 70 miles long. Melville Dozier and several other Oakland capitalists are interested in the company.

SANTA CRUZ, CAL.—The Pitt River Power Company has been incorporated for the purpose of generating and distributing electricity to be used in the operation of railroads, mines, tramways, etc.; also the furnishing of electricity for light, heat, etc., and also for distributing gas. The capital stock is $500,000, and the incorporators are J. H. Logan, J. F. Sheehan, Catherine F. Logan, H. E. Makinney and W. T. Jeter.

LOS ANGELES, CAL.—Articles of incorporation for the Los Angeles & Owens River Railroad Company were filed recently, the directors for the first year being William J. Hunsaker, A. W. Chaffey, Stanley P. Jewett, George Chaffey and George B. Reeve. The capital stock of the corporation is set at $10,000,000, of which amount $360,800 is subscribed, 10 per cent of which is paid in. According to the articles of incorporation, the purpose is to build and operate railways, telegraph and telephone lines through Owens Valley to Johannesburg on the Santa Fe, and to Vincent, on the Southern Pacific. The power is to be derived from the streams that have been filed upon by George Chaffey.

COLORADO SPRINGS, COL.—Articles of incorporation have been filed for the Michoacan Power Company, with a capital stock of $1,000,000, by William Watertown and others, to operate in the Mexican mining districts.

BOISE, IDAHO.—The Western Power Company has been incorporated, with a capital of $2,250,000, by L. A. Choate, of Boise, and J. B. Choate, of Atlantic, Ia., to construct a power plant of 20,000 hp capacity at the outlet of Ox Bow tunnel. Engineers are reported to be now on site and contracts for machinery will probably soon be let.

CHICAGO, ILL.—The Evanston & Interurban Electric Railway Company has been chartered with a capital stock of $2,500. The directors are Wesley A. Stranger and others.

TOLONO, ILL.—Articles of incorporation have been filed for the Tolono Light & Power Company, with a capital stock of $10,000. The incorporators are A. L. Vanmeter and others.

THEBES, ILL.—The Thebes & Cairo Telephone Company has filed articles of incorporation with the Secretary of State, with a capital stock of $5,000. The incorporators are W. W. Wilbourn, C. P. Spann and Albert Brawn.

ASSUMPTION, ILL.—Articles of incorporation have been filed for the Consolidated Electric & Manufacturing Company with the Secretary of State by David Lacharite, August Cazalet and E. W. Hight. The company is capitalized at $40,000.

CHAMPAIGN, ILL.—The Champaign & Kankakee Electric Railroad Company has been chartered to build an electric railway from Champaign to Chicago Heights. The capital stock of the company is $100,000, and the incorporators are E. D. Riser, R. A. McCracken, of Paxton, and others.

CHICAGO, ILL.—The Evansville, Mt. Carmel & Northern Railway Company has been chartered with a capital stock of $10,000. The incorporators and the first board of directors are: W. C. Brown, J. Cartensen, New York, N. Y.; C. E. Schaff, G. J. Grammer, and W. J. Lynch, of Chicago.

AURORA, ILL.—The Aurora Railway Company has filed articles of incorporation with the Secretary of State, with a capital stock of $300,000. The new company was formed by the same financiers as the Aurora, Dekalb & Rockford Railway, and the plan is to take over the franchise for the city lines recently granted the company to enter the city.

TELL CITY, IND.—The Citizens' Telephone Company has filed articles of incorporation, with a capital stock of $10,000. Vincent Smith is one of the directors.

GREENFIELD, IND.—The Westland Telephone Company, of Hancock County, has filed articles of incorporation with the Secretary of State. J. F. Coffin, Wm. H. Powers, Levi Greeley and Henry Cobb are the directors.

NOBLESVILLE, IND.—Articles of incorporation have been filed for the organization of the White River Light & Power Company with a capital stock of $600,000. The board of directors is composed of Dr. A. Booth and Thomas Griffin, of Noblesville; W. E. Kurtz, August H. Kuhn, John T. Dickson, Charles F. Buschaupt, R. O. Hawkins and Horace Smith, of Indianapolis, and R. H. Sharp, of Columbus, Ohio. The purpose of the company is to complete the dam across White River, near this city, which was begun two years ago by the Noblesville Hydraulic Company. The plant when finished will furnish this city with electricity for light and power. The company has recently placed an order for machinery involving an expenditure of $200,000.

ARDMORE, I. T.—Application papers for the incorporation of the Ardmore Electric Transit Company will be filed by W. F. Whittington, Joseph F. Robinson, and others, for the purpose of building a street car line in this city.

LAKE ARTHUR, LA.—Articles of incorporation have been filed for the Lake Arthur Ice, Light & Power Company, with a capital stock of $15,000. Walter R. Abney is president.

WINFIELD, LA.—The Winfield Parish Telephone Company has been chartered, with a capital of $5,000. The main office of the company is at Royal. The directors are: C. W. Smith, W. W. McCarty, J. J. Thornton, J. W. Higdon and S. R. Newsom.

PORTLAND, ME.—The Kanakee Light, Heat & Power Company has been organized for the purpose of owning and operating plans for generating light, heat and power. The capital stock is $100,000. The officers are Millard W. Baldwin, of Portland, president; Clarence E. Eaton, of Portland, treasurer.

BIDDEFORD, ME.—The Southern Dutchess Gas & Electric Company of Maine, has filed a certificate of organization with the Secretary of State for the purpose of dealing in stocks, bonds and other securities issued by the Southern Dutchess Gas & Electric Company, of New York. The company has a capital stock of $100,000. The officers are: George B. Goodwin, of Biddeford, president; John A. Snow, of Scarboro, treasurer.

Legal.

TELEPHONE FIRE ALARM.—That a telephone company is liable for the negligence of its operator in reporting a fire alarm is the decision of the courts at Chickasha, Oklahoma, where Mrs. M. E. Tripp sued the Pioneer Telephone Company for $125 because of a delay by the central operator in reporting a fire that destroyed a barn on her premises a few weeks ago. It was proved that as soon as the fire was discovered an attempt was made to get the fire department, but that it was impossible to do so for fully fifteen minutes. The judge held that the company was liable because it had not kept its wires in good repair and because the operator, an employe of the company, had been guilty of negligence.

ON A TIN ROOF.—The trial of the case of the Allegheny County Light Company against the Western Union Telegraph Company for $5,000 damages came up last week. The case is an interesting one in that the plaintiff company brings suit to recover the amount, with interest, it had to pay in a damage suit brought by Fred Shaffer, a tinner, for injuries received by coming in contact with the electric circuit of the Allegheny County Light Company's plant nearly six years ago. In its statement the Allegheny County Light Company alleges that on April 20, 1901, the Western Union had an electric clock wire running into the Bank for Secured Savings in Beaver Avenue, Allegheny, and that that wire fell on to the plaintiff company's light wire, increasing its voltage to such an extent that the plaintiff company's wire burned in two on top of the house of a Mr. Thompson in Lincoln Avenue, nearly a mile away. An end of the severed wire, it is claimed, fell on the tin roof of the Thompson house, charging it to a high voltage, and when Shaffer went to paint the roof he received a shock, hurling him to the ground. He got a verdict for $3,250. J. S. Ferguson filed a plea of limitation for the defendant company.

Educational.

WORCESTER POLYTECHNIC.—A contract has just been closed by the Worcester Polytechnic Institute for apparatus of the General Electric Company's manufacture, for a considerable portion of the equipment of the electric railway laboratory in the new building. This contract includes a motor-generator set, a four-motor electric car equipment, a complete set of multiple unit control apparatus, a complete air brake equipment and an extra pair of railway motors. The motor-generator set is composed of a 300-hp, 2,200-volt, 60-cycle synchronous motor, mounted on the same base and direct-connected to a 200-kw rotary converter, arranged to deliver either 600-volt direct current, or 400-volt, two-phase or single-phase, 25-cycle alternating current, as may be required. This machine will have an overload capacity of 50 per cent, so that either direct current at 500 or 600 volts or alternating current at 25 cycles will be available for use. A set of Westinghouse electropneumatic unit switch control has also been acquired.

NEW EDUCATIONAL CLUB.—The employes of the Gregory Electric Company, 16th and Lincoln Streets, Chicago, organized on November 9, an electrical club which will meet hereafter regularly, every two weeks. About 75 members have so far gone into this club. Mr. A. L. Kuhmasted, president of the Gregory Electric Company, gave an address on the history of electricity. Mr. J. D. Zook read a paper on "Shop Practice," and Mr. G. C. Besold gave a general talk, outlining the purposes of this club. A systematic course of lectures will be given on electricity and its applications, and the same will be demonstrated with the machines in actual operation at the works of the Gregory Electric Company. Papers will also be read at each meeting on various topics of interest by different members, collected by the progress committee, and a general discussion will follow. The meetings take place at 5.15 and last one hour, so that all who may can attend directly after quitting work. It is believed that these meetings will result in a great deal of benefit to all of the members and that the interest in these meetings will be maintained.

EVENING TECHNICAL COURSES.—The Board of Extension Teaching of Columbia University announces a series of nine evening technical courses which will be given at the University this winter, beginning Nov. 26, and lasting twenty weeks. The courses are under the immediate direction of Professor Walter Rautenstrauch, of the Faculty of Applied Science, and are to be given by professors and instructors of the University and other persons especially qualified. Moderate fees ($7.50 to $15) are charged and most of the courses are for two evenings a week. The courses are as follows: Engineering Physics, as illustrated in the mechanical plants of modern buildings. (1) An elementary study of physics; (2) a practical study of steam and electrical machinery, heating, ventilating, water system, wiring, elevators, etc., included in the plant of Columbia University. For two classes of student; those wishing an introductory study of physics as preparation to advanced study in electricity, steam, etc., another winter; those desiring practical training for positions as superintendents of buildings, engineers, janitors, etc. Elementary Mathematics: Those parts of arithmetic, algebra, geometry and trigonometry used in technical work. Practice with engineering hand-books, tables, etc. Drafting: A beginner's course; fits for positions as draftsmen; reading of drawings, etc. Strength of Materials: A lecture course for those who design or manufacture machinery, or modern structures. With this course should be taken either the first or second of the two following courses in design. Machine Design: Advanced drafting, computations and designing for persons engaged in the design and manufacture of machinery. Structural Design: Advanced drafting, computations and designing for those who do structural work. Electrical Engineering: A course especially for those engaged in electrical work of any sort. Steam Engineering: A course for those engaged in the management of steam machinery of any sort. Special Engineering Problems: A study of any special elementary or advanced engineering problems desired by the student. Individual instruction will be arranged for such a period of time as the special problem may demand. The courses will be given in the buildings of Teachers College, Columbia University, at West 120th Street and Broadway, which affords necessary lecture rooms, laboratories, drafting rooms, etc. A complete catalogue of these courses will be sent on request, by addressing Evening Technical Courses, Extension Teaching, Columbia University. Personal information may be secured Tuesday and Thursday evenings, between 7.30 and 9 o'clock from Mr. Benjamin R. Andrews, Room 111, Teachers College.

Obituary.

DANIEL J. LUDWIG, aged 64 years, manager of the Brooklyn, N. Y., office of the Stock Quotation Telegraph Company, died at his home in that borough, Nov. 13. Mr. Ludwig, who was a native of White Bear, Pa., was a member of the United States Military Telegraph Corps during the Civil War. In connection with his brother, Edward J. Ludwig, he assisted in organizing the Commercial News Department of the Western Union Telegraph Company, and was manager of that branch of the service in New York for many years. He also organized, and was the superintendent of a similar service for the Baltimore & Ohio Telegraph Company, New York. After the consolidation of this company with the Western Union in 1888, Mr. Ludwig became identified with the Stock Quotation Company, with which he remained until his death.

Personal.

MR. ALLEN E. RANSOM has resigned as electrical engineer of the Lewiston-Clarkston Company, Seattle, Wash., to associate himself with Mr. E. W. Cummings, consulting and construction engineer, Seattle.

MR. W. F. HYNES, construction engineer of the Allis-Chalmers Company, has just returned from Chili, where he installed a gas-driven electrical generating and air compressor plant in a copper smelting and converting works at Caldero, Chili.

MR. M. R. PORTER has been appointed sales manager of the Pittsburg Gage & Supply Company of Pittsburg. He has for many years occupied a similar capacity as an officer and director of the Belknap Hardware & Mfg. Company, of Louisville, Ky.

MR. E. D. ADAMS, member of the executive committee and directorate of the Allis-Chalmers Company, has returned from a trip to Europe.

MR. JOSEPH S. WELLS has been appointed acting general manager of the Utah Light & Railway Company of Salt Lake City, vice Mr. R. S. Campbell resigned. Mr. O. A. Honnold has been appointed chief engineer, and the office of electrical engineer has been abolished.

MR. LEONARD ANDREWS, the managing director of the Key Engineering Company, of London, has been visiting America recently with Mrs. Andrews, and looked up various matters connected with recent electrical developments in this country. He sailed for home on Saturday last.

MR. T. F. RYAN has announced that he is withdrawing from many directorates and will not hereafter take an active part in the management of any traction, lighting or railroad companies. It is expected that his sons will succeed him in such capacities. He will still have plenty of other executive work to keep him busy.

MR. ROBERT R. CHOATE, of Muskegon, Mich., for the past nine months manager of the Muskegon Traction & Lighting Company's commercial department, expects to leave this place soon for Knoxville, Tenn., to accept a similar position there with the Henry L. Doherty Company. Philip Buckley, for several years an employe of the Traction and Lighting Company, will succeed Mr. Choate.

MR. A. D. BOWEN, with Messrs. R. S. Masson and F. S. Viele, announces that they have formed the Electric Operating Construction Company, of 49 Wall Street, New York, which will manage, improve, reconstruct, organize or finance electric and kindred public utility companies and enterprises. The triumvirate is a strong one and should find a large amount of work ready to its hand.

MR. W. E. S. DYER, formerly manager of the Reeves Engine Company, Philadelphia, Pa., has been appointed manager of the Philadelphia office of the A. D. Granger Company, Commonwealth Building, Philadelphia, Pa. With his new connection Mr. Dyer will handle not only the vertical automatic engines built by the Bates Machine Company, of Joliet, Ill., but the Skinner automatic engines and the fire and water tube boilers which the A. D. Granger Company manufactures. Mr. Warren A. Peters will remain at the Philadelphia office with Mr. Dyer.

MR. B. R. SHOVER, formerly the head of the electrical department of the Ohio plant, Carnegie Steel Company, is now at the head of what will be the largest electrical plant of the entire world. The plant is that of the Indiana Steel Company, a subsidiary company of the United States Steel Corporation which is being built at Gary, Ind. Mr. Shover resigned his position at the Ohio plant after having been there since it was started. He made a record there and when it was decided that the new plant would be built he was chosen to take charge of the electrical part. Practically every part of the huge plant will be run by electricity from the start to the finish. It is an adaption of electricity to the manufacture of steel which has never been known before. The new plant when completed will make use of substantially 5,000,000 tons of ore per year and will produce annually nearly 2,500,000 tons of steel.

MR. W. M. EATON.—Mr. W. M. Eaton, vice-president of the Rochester Railway and Light Company, has tendered his resignation, which will take effect at his discretion, some time between now and January 1. The company has accepted the resignation. Mr. Eaton will enter the service of Hodenpyl, Walbridge & Company, bankers, of New York. The firm was formerly associated with the Philadelphia firm of E. W. Clark & Company, bankers, in the control of the Rochester public service corporation, The Hodenpyl-Walbridge-Clark syndicate sold its holdings to the Vanderbilt-Andrews syndicate which owns the Mohawk Valley Company. Mr. Eaton was in Rochester about two and one-half years on leaving Grand Rapids, Mich. Since going to Rochester he has planned all the extensions and improvements which have been made to the local plant. Last August Mr. Eaton was succeeded as general manager of the company by R. M. Searle.

NEW YORK ELECTRICAL SOCIETY.—The following members were elected at the last meeting of the New York Electrical Society: Richard Maetzel, 15 Dey Street, New York; F. A. Forgee, 30 West 32nd Street, New York; Wm. F. Richards, 1244 Madison Avenue, New York; Wm. McIntosh, 371 Henry Street, Brooklyn; Fremont Wilson, 34 Pine Street, New York; Thomas P. Peck, Jr., 11 Pine Street, New York; Chas. A. Mudge, 76 North 19th Street, East Orange, N. J.; Arthur T. Bolton, Marion Avenue, 200th Street, New York; John T. Trudeau, 11 Pine Street, New York; G. N. DuBarry, Jr., Westinghouse E. & M. Co., 11 Pine Street, New York; A. Ottison Miller, 97 Sixth Avenue, Brooklyn; Matthew Loughbridge, 1109 Central Avenue, Westfield, N. J.; Adolph Westman, N. Y. Telephone Company, 52 Duane Street, New York; James J. Smith, 11 West 100th Street, New York; Robert Stewart Sutliffe, N. Y. Telephone Company, 15 Dey Street, New York; Samuel L. Greer, N. Y. Telephone Company, 15 Dey Street, New York; Ernest F. Hartwell, R. & H. Simon, Union Hill, N. J.; H. Stiller, 95 Pitt Street, New York; H. Klein, 211 East 3rd Street, New York.

MR. M. G. STARRETT has resigned as chief engineer of the New York City Railway Company and has been appointed consulting engineer of the company and its leased and allied lines. The office of chief engineer of the New York City Railway Company has been abolished. Mr. Starrett has been connected with the New York City Railway Company since 1896 when he was appointed assistant chief engineer, and has occupied the office which he has just resigned since 1899. During the ten years which Mr. Starrett has been connected with the system, the three present power stations and all of the sub-stations of the company have been built, and the greater part of the underground conduit electrical lines in operation were installed. The Ninety-sixth Street, or main, power station of the company was the first of the large electric railway stations of the country in general polyphase transmission with substations and was the first in which generators of 3,500 kw were used. Previous to his New York connection Mr. Starrett was assistant engineer of the West End system in Boston and for five years chief engineer of the Brooklyn City Railway Company and had charge of the electrification of that company's lines and the erection of its two power stations at Kent Avenue and Fifty-second Street.

Trade Publications.

ELECTRIC NOVELTIES.—Numerous electric novelties, especially suited to the Xmas trade, are described in an illustrated catalogue published by the Ohio Electric Works, Cleveland, Ohio.

GRINDING MACHINERY.—A price-list of emery wheels and of grinder heads and water attachments has been issued by Patterson, Gottfried & Hunter, 146 Center St., New York.

PANEL BOARDS.—A neatly illustrated catalogue dealing with panel boards, and especially arranged for ready reference by architects and engineers, has been issued by the H. Krantz Manufacturing Company, Brooklyn, N. Y.

COPPER REFINING MACHINERY.—Catalogue No. 6 of the Power & Mining Machinery Company, Cudahy, Wis., is a 156-page publication dealing with machinery for the roasting, smelting and refining of copper and silver-lead ores.

WATER-TUBE BOILERS.—A neat catalogue issued by the A. D. Granger Company, 95 Liberty St., New York, is devoted to Star water-tube boilers, which are characterized by the small space required, rapid steaming and large factor of safety.

ENGINEERING WORK.—Catalogue A of the Wellman-Seaver-Morgan Company, Cleveland, Ohio, gives a brief illustrated description of examples of mechanical, civil, electrical, mining and hydraulic work for which the company acted as consulting engineers.

PORTABLE LAMPS.—The Goodwin & Kintz Company, Winsted, Conn., has issued as catalogue No. 28, an illustrated description of an exceptionally complete line of gas and electric portables, electroliers and newels. The designs run from the cheapest to some of the finest shown to the domestic trade.

HEATING MACHINES.—An illustrated booklet recently issued by the Rockwell Engineering Company, 26 Cortlandt St., New York, gives an outline of apparatus suitable for annealing, hardening, tempering or coloring quantities of similar pieces of gold, silver, bronze, brass, copper or steel.

RAPID MILLING.—The Cincinnati Milling Machine Company has issued as a supplement to its complete milling machine catalogue a special 64-page publication entitled "Examples of Rapid Milling," which embodies some entirely new matter, particularly some illustrations and data relating to work done on direct-connected motor-driven machines.

SUGGESTIONS FOR SELLING.—The Yale & Towne Manufacturing Company has issued a neat booklet calling attention to the various advertising schemes for increasing the sales of padlocks, the literature for which it is prepared to supply to hardware dealers. The plans proposed include a large number of original ideas which might well be employed in connection with the sale of other commodities.

ELECTRIC CRANES.—The Case Manufacturing Company, Columbus, Ohio, has issued an artistic catalogue showing by half-tone reproductions of photographs the many improvements recently made in cranes. In discussing the alternating-current crane motors, it is stated that while it is a fact that the regulation of the alternating-current crane is not quite as accurate as is the direct-current, yet alternating-current cranes have been very successful in operation.

PRESSES AND DIES.—A fair idea of the magnitude of the special machinery business may be gained from the fact that the E. W. Bliss Company, Adams and Plymouth Streets, Brooklyn, N. Y., has issued a book of 578 pages as its 1906 catalogue of presses, dies and similar machinery. The machinery described and illustrated relate to all types of punching and shearing machines, including those particularly adapted for use with the laminated cores of motors and generators.

STORAGE BATTERIES.—Bulletin No. 101 of the Electric Storage Battery Company, Philadelphia, Pa., gives a complete illustrated description of the storage battery equipment of the Columbus Railway & Light Company, at Columbus, Ohio. Recording voltmeter charts serve to show the efficacy of the battery in preventing fluctuations in the e.mf. while recording hydrometer charts show the density of acid at each hour of the day and thus indicate the value of charge remaining in the battery.

AIR COMPRESSORS.—The Allis-Chalmers Company, Milwaukee, Wis., has issued bulletin No. 1507, giving an excellent discussion of the inherent characteristics of air compressors. Although the bulletin is intended principally for describing the construction and operation of Allis-Chalmers compressors, much of the matter is of a technical nature, and much valuable general information is given. Among the several tables relating to compressed air data is one showing the "horse-power required to compress a cubic foot of air from atmospheric pressure to various gauge pressures," the time not being specified. Doubtless the omission can readily be supplied by those accustomed to deal with compressed air calculation. Other tables treat of volumetric efficacy at various altitudes, volume of air at various pressures, piston displacement and transmission of air through pipes.

TELEPHONES.—The Holtzer-Cabot Electric Company, Brookline, Mass.. prepared some interesting publications for distribution at the National Business Show, in New York. Booklet 148AB illustrates and describes each of the interior telephone instruments which the company manufactures. Among those which have not been heretofore included in publications because of their recent development are a single point circular floor wall telephone, a single point school type telephone, a hand microtelephone, a complete central energy wall set and new form of magneto wall telephone, a folder on annunciators, which is printed in four different colors, includes the standard patterns of annunciators. The combination return call bell and button which operates in conjunction with hotel annunciators is something new which is offered to the public. The patterns of elevator annunciators which are shown, are also new. Attention is invited to systems of silent signaling for restaurants and stores, on the last page of the folder.

SCIENTIFIC INSTRUMENTS.—The Cambridge Scientific Instrument Company, of Cambridge, England, has issued a most interestng new catalogue on Technical Thermometry, which should be in the hands of all to whom that subject is important. The first part of the list is devoted to showing the many applications of electrical thermometers; the electric resistance thermometers, thermo-electric thermometers and the Fery radiation pyrometer being described and explained in full detail. The list is divided into three sections: I. Dealing with the more particular commercial applications of pyrometers. II. Dealing with scientific or research work. III. An appendix explaining the theoretical considerations of the instruments. and giving tables of general interest. Among the latter specially attention is called to the table of melting points by Dr. Harker of the National Physical Laboratory. These values will be found to differ very materially from those generally accepted in textbooks. The company calls particular attention to the thread recorder, an instrument it believes has a large future before it.

DIRECT-CONNECTED GENERATORS.—The Crocker-Wheeler Company, Ampere, N. J., has recently published Bulletin 69, describing a specially arranged generator for direct connection to steam or gas engines. The company has taken its celebrated Form I machine, which as a motor is well known in the machine tool field, and has made some modifications in the design, which bring the machine into the market as a dynamo. These generators are built in sizes to give outputs of 1½ kw to 19 kw and meet the demand for small direct-connected units for isolated plants and residences. The commutator end of the shaft is carried in a bearing supported by a rigid bracket which is bolted to the side of the frame, and the inner end of the shaft is finished to receive the engine coupling. For the convenience of those who wish to purchase complete generating sets, the Crocker-Wheeler Company has arranged with a number of the leading engine builders to supply complete direct-connected sets with C-W generators. Bulletins illustrating these special combinations may be obtained from any of the branch offices of the company.

News of the Trade.

JOHNS-MANVILLE OFFICE.—Owing to its increasing business in the city and vicinity of Baltimore, the H. W. Johns-Manville Company has opened a branch office at No. 315 Equitable Building, Baltimore, Md. This office will be in charge of Mr. W. F. Baird, previously connected with the Philadelphia branch of the company.

DINNER AT SHERRY'S.—The Electric Cable Company, 17 Battery Place, New York, will give a dinner at Sherry's on the evening of Dec. 8, which will be attended by the representatives of its various interests who have been most closely identified with the Electric Cable Company during the past year. Those present will be: Edwin W. Moore, president of the company, New York; Frederick H. Cowles, vice-president; J. Nelson Shreve, treasurer; J. Allen Haines, Chicago, manager; Hamilton Hill, Boston manager; Russell A. Cowles, treasurer Ansonia Brass and Copper Company, Bridgeport, Conn.; A. Parker Nevin, attorney; A. E. Kalbach, general manager of the New York City Interborough Company; W. Y. Lewis, chief engineer Pearson Sons Co., London; H. W. Baker, cashier Interborough Bank; T. P. Artaud, of the Hudson Companies, and Kendall Banning, of Bruce & Banning.

CHASE-SHAWMUT COMPANY.—Central station managers have for a long time felt the need of a reliable method of removing the dangers connected with secondary distribution systems. With this end in view the Chase-Shawmut Company of Newburyport, Mass., has put on the market the Shawmut all-copper ground connection clamp, which they offer as a means of overcoming these dangers so prevalent with secondary systems. This clamp is made of two pieces of copper held together with an iron bolt, and is made to fit any size of pipe from one-half to three inches. A terminal lug is provided large enough to take a No. 4 wire. With the secondary circuits grounded by these clamps, the best possible protection against fire and personal injury will be provided. The Chase-Shawmut Company is now preparing a little pamphlet on the all-copper ground conconnection clamp which it will distribute among the trade, bringing out the features of its simplicity, strength and large contact area.

THE BOSTON EDISON COMPANY has placed another order with the Stanley-G. I. Electric Mfg. Company for 500 Wright demand indicators, making a total of, approximately, 20,000 of these instruments used in the territory served by the Boston Edison Company. The Chicago Edison Company has, approximately, 30,000, Wright demand indicators in use in connection with the demand system of charging for current, in vogue in that city. The Wright demand indicator determines the actual maximum current which passed through it since it was last set. Connected in series with a watt-hour meter, it offers a logical and scientifically correct means of charging for electricity. It is also extremely useful in checking up the load on transformers and thereby suiting them to the requirements of their respective circuits. Valuable data regarding the progress of the demand systems of charging for electricity and interesting discussions on the subject may be had by addressing the Stanley-G. I. Electric Mfg. Company, Pittsfield, Mass.

MILAN HONORS FOR AMERICAN EXHIBITOR.—The International Jury of the Milan Exposition has just announced the award of a Diploma d'Onore to the "Long Arm' system of electrically operated bulkhead doors. The award takes higher rank than the gold medal granted by the jury in some cases. The "Long Arm" System Company, of Cleveland, Ohio, had an elaborate installation of its watertight doors at the Exposition, and so much attention was attracted by the exhibit as to give rise to a demand upon the government to make the installation of electrically operated bulkhead doors on large passenger ships obligatory. Some time ago the "Long Arm" system passed the severe tests put upon it by the United States Navy Department, and the electrical doors and hatches of this system are now in use upon most of the new American warships. From a central emergency station above deck, all the principal bulkhead doors can be closed in a few minutes. The great advantage gained is that the electrical control makes closure of the doors possible under all circumstances, even in the event of a hull puncture below the water line, or when the conditions would make it impracticable to close bulkhead doors by hand against inrushing water.

ALLIS-CHALMERS STEEL VENTILATING FANS.—The Allis-Chalmers Company, for some years past, has made a specialty of large ventilating fans with diameters varying from 12 to 35 feet. These are of the double-intake center draft stype. They are built up of sheet steel and angles, the blades being rapidly fastened to sheet steel arms, which are in turn clamped between two cast iron centers, so shaped as to present the least possible resistance to the air as it enters the fan; the blades are also well braced to insure their running true. The sides of these fans are enclosed, from the periphery of the intake to the periphery of the outside or top of blades, by steel plates reinforced by angle rings on the outside, and by angles on the sides of the blades on the inside. This construction not only insures a strong, rigid fan for heavy duty, but it prevents all loss of air due to clerance between the fan and the side of housing, and also reduces the friction for the same reason . The fan is usually mounted upon a hammered iron shaft secured to it by heavy keys. Then large set collars in halves are placed one upon either side against the fan centers and clamped in recesses turned into the shaft; these prevent the fan from working upon the shaft. A bronze bushed water jacketed bearing is placed upon either side of the fan, and those bearings, braced by suitable columns, are supported on long pole plates, the ends of which rest on the foundation and are securely bolted to it. These fans may be arranged for direct connection to the motive power or provided with pulleys for belting, depending upon the conditions of service, but in either case the apparatus is made exceptionally compact and combines maximum efficiency and durability with minimum bulk and weight. When the fans are required to be placed in damp and dirty passages, the direct connected unit has many advantages, for the use of belting under such conditions is far from desirable. The limited space available in such cases is also another argument in favor of this arrangement. The fans may be driven either by small Allis-Chalmers "Reliance" Corliss engines or by Allis-Chalmers motors—preferably induction motors, where alternating current can be supplied.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED NOV. 13, 1906.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 140 Nassau St., N. Y.]

835,493. CUT-OUT; Rollin A. Baldwin, New Haven, Conn. App. filed Sept. 8, 1905. An inexpensive cut-out adapted particularly for use on street railroad signal installations for inserting a second lamp into the circuit when the regular signal lamp fails.

835,495. ARTICLE OF AN ALLOY OF IRON AND HYDROGEN AND PROCESS OF PRODUCING THE SAME; Augusto Bontempi, New York, N. Y. App. filed Aug. 7, 1906. An article consisting of an alloy of iron and hydrogen impregnated with a metalliferous material, as set forth.

835,504. BEND, ELBOW AND OTHER ANGLE PIECE FOR ELECTRIC CONDUITS; David M. Edwards and Ernest A. Brown, Kilburn, England. App. filed July 7, 1905. Relates to bends, elbows, tees and four-way fittings. The parts are made with a removable longitudinal cover so that the wires may be inspected or removed as often as desired.

835,516. ELECTRIC CLOCK; Peter G. Giroud, New York, N. Y. App. filed Oct. 25, 1905. Relates to details of winding mechanism of an electric clock which has a weighted arm periodically raised by an electro-magnet to furnish the power.

835,529. PORTABLE ELECTRIC LIGHT; Conrad Hubert, New York, N. Y. App. filed May 19, 1905. A pocket battery lamp in which the circuit is opened and closed by sliding the lens and lamp socket laterally on the battery casing.

835,605. TRAIN ANNUNCIATOR; Edward A. Everett, Detroit, Mich. App. filed May 8, 1906. Relates to the lever mechanism of an annunciator drop adapted to be actuated by feeble impulses in a relay magnet.

835,618. FUSE; Otto C. Hoffman, Chicago, Ill. App. filed Feb. 26, 1904. A fuse comprising a tube, two terminals, one at each end, each ter-

minal having a flattened portion beyond the end of the tube and a stop to abut the tube, such stop being a projection from the wall of the terminal extending inwardly therefrom and a fuse within the tube and connected to the terminals.

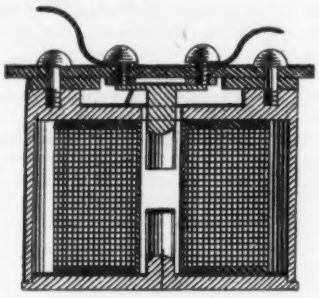
835,642. ELECTRIC ACCUMULATOR; Paul Schmitt and Charles Fabre, Paris, France. App. filed Nov. 6, 1902. A storage battery plate which is cast with a number of laterally extending shelves or strips which are bent around so as to enclose the active material.

835,647. TELEGRAPH INSTRUMENT; Daniel O. Stinson, Falkville, Ala. App. filed Aug. 26, 1905. A combined relay and sounder designed to do away with local batteries.

835,661. ELECTROLYTIC PROCESS OF MAKING BASES OF THE ALKALI-EARTH METALS; Andre Brochet and Georges Ranson, Paris, France. App. filed Feb. 14, 1901. A chemical process using a sulfid of alkaline earth and a chloride of alkaline earth as electrolytics separated by a diaphragm.

835,685. INSULATING MATERIAL AND METHOD OF MANUFACTURING SAME; George Kelly, Hinsdale, Ill. App. filed Apr. 24, 1906. That improvement in the process of manufacturing insulating material, which consists in intermingling with a fiber having zinc oxid therein, a vulcanizing-binder and vulcanizing the composition under heat and pressure.

835,704. SELECTIVE SIGNAL FOR TELEPHONE SYSTEMS; Michael H. Degnan, Nashua, N. H. App. filed Feb. 20, 1906. The combination with the shaft having a cam and a station-index thereon, of the tilting box having a follower which rests upon the cam, and a circuit-closing roller in the box.



834,493.—Cut-Out.

835,728. CONTACT SPRING FOR TROLLEY HARPS; John Hensley, Huntington, Ind. App. filed Mar. 22, 1906. Relates to a spring washer which is inserted between the harp and the wheel so as to maintain a good electrical contact.

835,731. TROLLEY FOR ELECTRIC RAILWAYS; Ezra F. Landis, La Salle, N. Y. App. filed Sept. 11, 1905. The wheel has a pair of annular grooves at the point of its engagement with the wire and in these grooves are received specially formed springs which slide in the grooves and close over the trolley wire to hold the same upon the wheel.

835,750. AUTOMATIC TRANSMITTER FOR TELEGRAPHIC SYSTEMS; John Gell, Highdate, London, England. App. filed Nov. 26, 1904. Has a star feed wheel and a guide or shoe having a groove for the feed wheel to work in, said shoe being formed of transparent material.

835,751. AUTOMATIC TRANSMITTER FOR TELEGRAPHIC SYSTEMS; John Gell, London, England. App. filed Sept. 29, 1905. Relates to modifications of the above.

835,755. ELECTRICAL MEASURING INSTRUMENT; Frank Holden, Rugby, England. App. filed Jan. 2, 1904. An ammeter of the movable coil type having the permanent magnets of hard steel with integral pole pieces of soft steel.

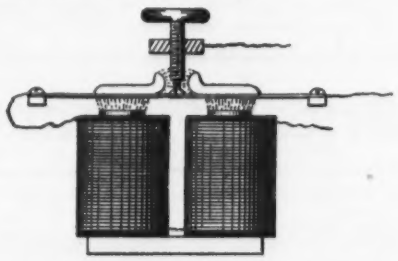
835,762. WATCH STAND; Max Koller, Winterthur, Switzerland. App. filed Sept. 27, 1905. A sheet metal watch stand or support having a casing in which is contained an incandescent lamp and a dry battery.

835,763. ELECTRIC CURRENT REGULATOR; Oscar H. Pieper and Alphonse F. Pieper, Rochester, N. Y. App. filed Feb. 7, 1906. A small regulator for dental motors in which the parts are so disposed within the casing that they may be removed without disturbing the electrical connections.

835,772. TELEGRAPH REPEATER; Paul E. Bliss, Leesburg, Va. App. filed Apr. 18, 1906. A system of connections for a telegraph repeater, the circuits of which are specifically claimed.

835,801. TELEPHONE-WIRE-SECURING MEANS; Harvey W. Ragsdale, Morgantown, Ind. App. filed June 19, 1905. A tool having a lever by which the wire is deflected so as to be stretched between two guiding pins.

835,802. TELEPHONE-EXCHANGE SYSTEM; Harry G. Webster, Chicago, Ill. App. filed Dec. 16, 1904. Complete diagram of cord and relay circuits for a telephone system.



12,558.—Electric Interrupter.

835,816. ELECTRIC CANDLE LAMP; Constant K. Decherd, Meriden, Conn. App. filed Apr. 16, 1906. Relates to a sheet metal support for an electric lamp which is adapted to be used in a candelabra.

835,821. TROLLEY POLE CLAMP; Hugh W. Fellows and Ira A. Cammett, Los Angeles, Cal. App. filed Sept. 15, 1905. The trolley pole is removable and is secured to its hinge by a form of sliding wedge having rack teeth.

835,841. ELECTRIC HEATER; Frederick M. Vogel, Lynn, Mass. App. filed Mar. 31, 1906. An electric heater comprising a receptacle having a massive bottom and an electric heating device therein and having a superficial area exposed to the atmosphere so that the energy supplied and the energy lost by radiation are maintained equal.

835,860. MICROTELEPHONE; Arvid A. Lind, Malmo, Sweden. App. filed Feb. 28, 1905. Has a double diaphragm transmitter located in a plane parallel to the axis of the mouthpiece.

835,865. HEAD TELEPHONE SET; Joseph Pieringer, Jersey City, N. J. App. filed Dec. 1, 1905. Constructed with ball and socket joints so as to be adjustable.

835,868. CENTRAL-ENERGY SYSTEM FOR TELEPHONE-EXCHANGES; John G. Roberts, Evanston, Ind. App. filed Apr. 2, 1903. Complete cord circuit diagram for telephone exchange.

835,870. ALTERNATING CURRENT POLE CHANGER CIRCUIT; Edwin H. Smythe, Chicago, Ill. App. filed Feb. 1, 1906. Relates to a telephone system where a number of subscribers' sets on the same party line have differently adjustable vibrating bells so as to be operated by different alternating currents. Provides a special form of polechanger for transforming an alternating current into positive or negative pulsations.

835,879. AUTOMATIC TELEPHONE-EXCHANGE FOR DOUBLE WIRE TELEPHONE SYSTEMS; Gotthilf A. Betulander, Stockholm, Sweden. App. filed Apr. 5, 1904.

835,909. SECTION INSULATOR FOR TROLLEY ROADS; Charles M. Means, Punxsutawney, Pa. App. filed Apr. 9, 1906. A pair of hangers depend from a supporting base with specially formed porcelain bushings to furnish the insulation.

835,938. ELECTRIC INCANDESCENT LAMP; Francis M. F. Cazin, Hoboken, N. J. App. filed Feb. 2, 1899. In an incandescent lamp a permanent metal core covered with a film of other metal of less affinity for oxygen than the metal of the core, substantially as described.

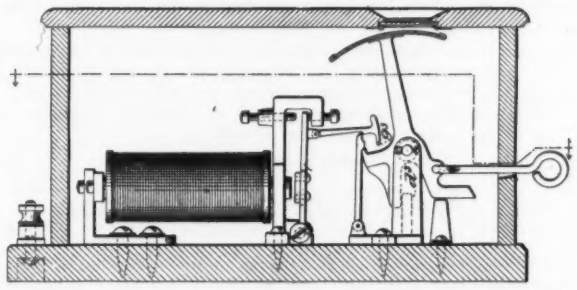
835,942. LIFTING MAGNET; Arthur C. Eastwood, Cleveland, O. App. filed Aug. 30, 1905. A cup-shaped piece of iron has an inverted brass cone inset therein and contains a magnet winding so as to produce a magnetic field to such small iron objects into the interior of the cup.

835,946. ELECTRIC GAS LIGHTER; Giorgio Giorgi, Florence, Italy. App. filed Sept. 16, 1905. A magnet operated cock for operating a gas light. A cut-out is placed on the gas meter so as to render the cocks inoperative in case the gas is turned off at the meter.

835,951. SIGNALING ON RAILWAYS; Charles M. Jacobs and Robert J. Insell, Reading, England. App. filed July 2, 1906. The engine has a depending arm which makes electrical connection with a special rail, and signal and alarm circuits are thereby completed to a point in the engine cab.

835,960. APPARATUS USED IN ELECTROPLATING; Albert J. Leaver, London, England. App. filed June 11, 1906. The combination of a vat, a trunk supported in the vat at a distance above the bottom of the vat, a screw-propeller in the trunk and means for driving the screw-propeller.

836,015. AEROPHONE; Lee de Forest, New York, N. Y. App. filed Dec. 11, 1905. An antenna transmitting circuit having an air or auto



835,605.—Train Annunciator.

coil by which the alternations of ordinary speech are increased in periodicity for the purpose of wireless transmission.

836,019. MULTI-VOLTAGE SPEED CONTROLLER; Alexander D. DuBois, Chicago, Ill. App. filed Jan. 13, 1906. Provides an arrangement of circuits whereby a motor may be employed in connection with circuits of varying voltage and wherein both variations in the field strength and in the armature current are utilized to vary speed of the motor.

836,036. AUTOMATIC MOTOR STARTER; William F. Hendry, New York, N. Y. App. filed Oct. 16, 1905. A system of contactors adapted to successively cut out sections of a resistance element. The contractors are successively actuated by relay mechanism.

836,049. SPRING JACK SWITCH; Charls H. North, Cleveland, O. App. filed Oct. 31, 1901. Is made of sheet metal stampings organized together to form a very compact jack. Is of the type having contacts in the jack to cut out the subscriber's lamp, rather than having subscribers' relays.

836,062. CIRCUIT CLOSER FOR TROLLEY SIGNALS; Alexander Bevan, Providence, R. I. App. filed Feb. 6, 1906. A box is adapted to be supported above the trolley wire and has a depending arm engaged by the trolley wheel to operate switch mechanism for the signal circuits.

836,067. OPERATOR'S RINGING AND LISTENING KEY; William W. Dean, Chicago, Ill. App. filed June 20, 1902. Mechanical details of construction of an operator's key mechanism.

836,070. OSCILLATION-RESPONSIVE DEVICE; Lee de Forest, New York, N. Y. App. filed May 19, 1906. An oscillation-responsive device comprising a partially-exhausted receptacle, separated electrodes sealed in said receptacle, means for heating one only of said electrodes, and a local circuit including a source of electrical energy and a signal-indicating device electrically connected with said electrodes.

836,071. OSCILLATION-RESPONSIVE DEVICE; Lee de Forest, New York, N. Y. App. filed May 19, 1906. An oscillation-responsive device, comprising a partially-exhausted receptacle, two separated electrodes sealed in said receptacle, and a circuit including a source of electrical energy and a signal-indicating device electrically connected with said electrodes, the said source of electrical energy being so adjusted as to render the said gaseous medium sensitive to electrical oscillations.

836,072. AEROPHONE; Lee de Forest, New York, N. Y. App. filed Dec. 11, 1905. In an aerophone, a transmitting-antenna means for developing electrical oscillations therein, and means in said antenna and located between the earth connection thereof and the point at which energy is supplied thereto whereby said oscillations may be varied.

12,558. ELECTRIC INTERRUPTER; Lars G. Nilson, Hoboken, N. J. App. filed Nov. 18, 1902. The spark gap of the vibrator is arranged in a magnet field so as to blow out the arc at the usual platinum contacts.